

SUID-AFRIKAANSE  
WETENSKAPLIKE EN NYWERHEID-  
NAVORSINGSRAAD

SOUTH AFRICAN  
COUNCIL FOR SCIENTIFIC  
AND INDUSTRIAL RESEARCH

DERTIENDE  
JAARVERSLAG

THIRTEENTH  
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1 April 1958.

Meneer,

*Met genoë lê ek die Dertiende Jaarverslag van die Wetenskaplike en Nywerheidsnavorsingsraad aan u voor. Hierdie verslag dek die tydperk 1 April 1957 tot 31 Maart 1958, wat met die einde van die Raad se boekjaar saamval.*

*'n Balansstaat en staat van inkomste en uitgawe vir die boekjaar geëindig 31 Maart 1958, soos nagesien deur die Kontroleur en Ouditeur-generaal, word aangeheg.*

*Dienswillig die uwe,*

*S. M. NAUDE,*

*President: Wetenskaplike en Nywerheidsnavorsingsraad*

*Sy Edele Dr. A. J. R. van Rhijn,  
Minister van Ekonomiese Sake,  
Paulhof,  
Minnaarstraat,  
PRETORIA.*



P.O. Box 395,  
Pretoria.  
1st April, 1958.

Sir,

*I have pleasure in presenting to you the Thirteenth Annual Report of the Council for Scientific and Industrial Research. This Report covers the period from the 1st April, 1957, to the 31st March, 1958, which coincides with the end of the Council's financial year.*

*Balance sheets and statements of income and expenditure for the financial year ended 31st March, 1958, certified by the Controller and Auditor-General, are included.*

*I have the honour to be,*

*Sir,*

*Your obedient servant,*

*S. M. NAUDE*

*President: Council for Scientific and Industrial Research*

*The Hon. Dr. A. J. R. van Rhijn,  
Minister of Economic Affairs,  
Paul Hof,  
Minnaar Street,  
PRETORIA.*





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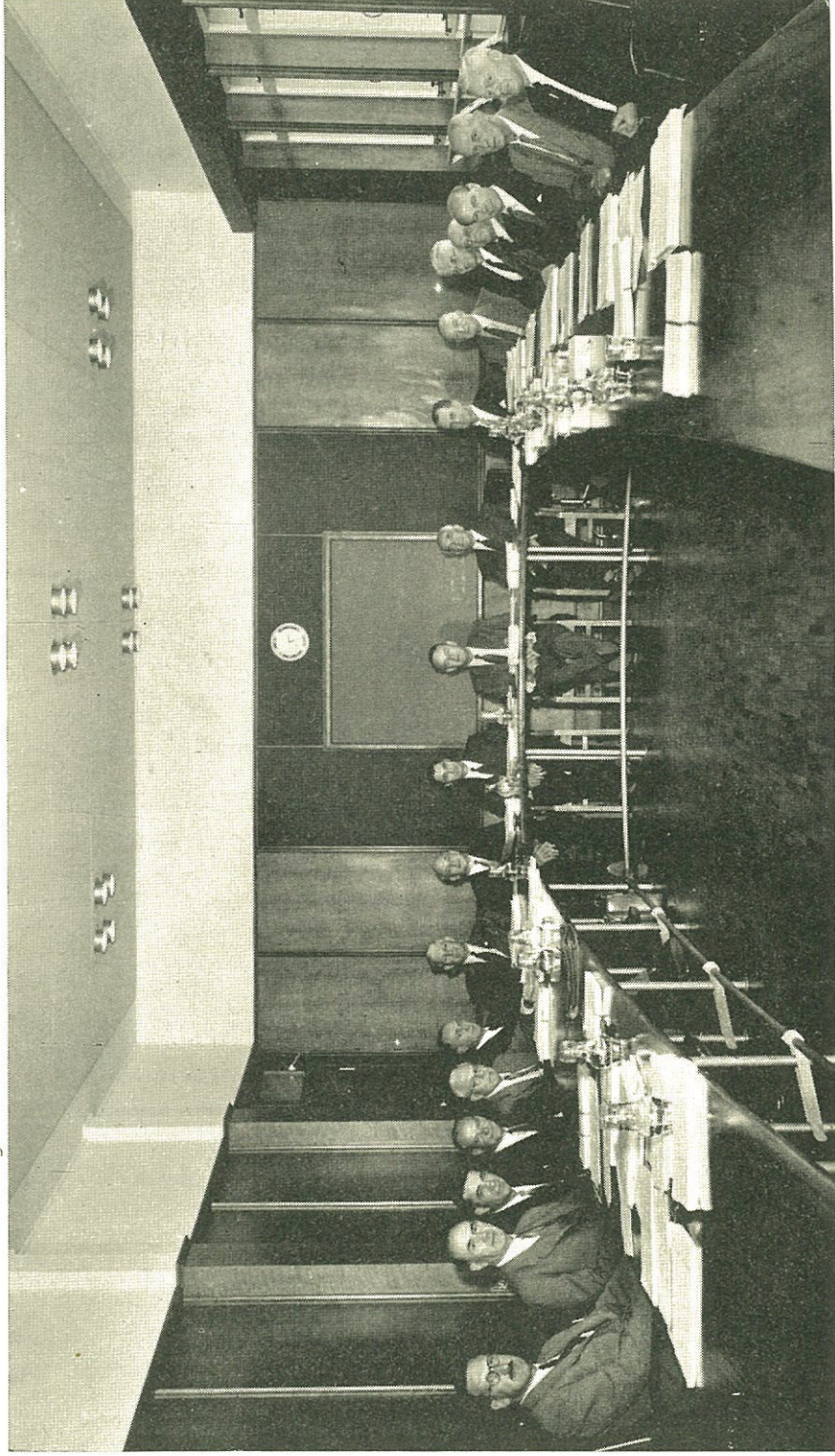
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DIE WETENSKAPLIKE EN NYWERHEIDNAVORSINGSRAAD — THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH



L-R: Mnr./Mr. P. E. Rousseau, Prof. W. G. Sutton, Dr. B. Gaigher, Mnr./Mr. F. G. Hill, Dr. R. W. Wilcocks, Dr. A. J. A. Roux (Vice-Vice President), Brig. J. H. Rauch, Dr. H. J. van Eck, Dr. F. J. de Villiers, Dr. S. M. Naudé (President), Dr. P. J. du Toit, Dr. H. O. Mönning, Mnr./Mr. J. E. Worsdale, Dr. T. Alty, Dr. G. C. Scully, Prof. S. F. Oosthuizen, Mnr./Mr. E. W. Dohse (Adviser/Adviser), Mnr./Mr. A. J. Miller-Smit (Sekretaris-Tesourier/Secretary-Treasurer).



## Ledelys en Vergaderings van die Raad

Onderstaande was op 31 Maart 1958 lede van die Raad:

Dr. S. M. Naudé .. ..	<i>President</i>
Dr. F. J. de Villiers ..	<i>Organiserende Direkteur van Nywerheidsontwikkeling, Departement van Naturelle-sake.</i>
Dr. P. J. du Toit, F.R.S.	<i>Voorsitter van die Raad vir Wetenskaplike Navorsing in Afrika Besuide die Sahara en voormalige President van die W.N.N.R.</i>
Dr. T. Alty .. .. .	<i>Prinsipaal en Vise-kanselier van die Rhodes-universiteit.</i>
Dr. B. Gaigher .. ..	<i>Kontroleur van In- en Uitvoer en Nywerheidsadviseur van die Department van Handel en Nywerheid.</i>
Mnr. F. G. Hill .. ..	<i>Tegniese Bestuurder, Rand Mines Ltd.</i>
Dr. H. O. Mönnig ..	<i>Besturende Direkteur, Agricura Laboratoria, Beperk, Voorsitter van die Adviserende Raad vir Wetenskaplike Beleid.</i>
Prof. S. F. Oosthuizen	<i>Voorsitter, S.A. Mediese Raad.</i>
Brig. J. H. Rauch ..	<i>Geneesheer-generaal, Unieverdedigingsmag.</i>
Mnr. P. E. Rousseau ..	<i>Besturende Direkteur, S.A. Steenkool-, Olie- en Gas-korporasie Beperk</i>
Dr. G. C. Scully .. ..	<i>Direkteur, Union Whaling Co. Ltd., en die Dundee Coal Co. Limited</i>
Prof. W. G. Sutton ..	<i>Prinsipaal, Universiteit van die Witwatersrand</i>
Dr. H. J. van Eck ..	<i>Voorsitter en Besturende Direkteur, Nywerheidsontwikkelingskorporasie.</i>
Dr. R. W. Wilcocks ..	<i>Voorsitter van die Universiteitsadviesraad en voormalige Rektor van die Universiteit van Stellenbosch.</i>
Mnr. J. E. Worsdale ..	<i>Voorsitter en Besturende Direkteur, White's S.A. Portland Cement Co. Limited.</i>
Sekretaris/Tesourier ..	Mnr. A. J. Miller-Smit, B.A., M.Com.

## Membership and Meetings of the Council

Membership of the Council on 31st March, 1958, was:

Dr. S. M. Naudé .. ..	<i>President.</i>
Dr. F. J. de Villiers ..	<i>Organizing Director of Industrial Development, Department of Native Affairs.</i>
Dr. P. J. du Toit, F.R.S.	<i>Chairman of the Council for Scientific Research in Africa South of the Sahara and former President of the C.S.I.R.</i>
Dr. T. Alty .. .. .	<i>Principal and Vice-Chancellor of Rhodes University.</i>
Dr. B. Gaigher .. ..	<i>Controller of Imports and Exports and Industrial Adviser to the Department of Commerce and Industries.</i>
Mr. F. G. Hill .. ..	<i>Technical Manager, Rand Mines Ltd.</i>
Dr. H. O. Mönnig ..	<i>Managing Director, Agricura Laboratoria Ltd., Chairman of the Advisory Council on Scientific Policy.</i>
Prof. S. F. Oosthuizen ..	<i>Chairman, S.A. Medical Council.</i>
Brig. J. H. Rauch ..	<i>Surgeon-General, Union Defence Force.</i>
Mr. P. E. Rousseau ..	<i>Managing Director, S.A. Coal, Oil and Gas Corporation Ltd.</i>
Dr. G. C. Scully .. ..	<i>Director, Union Whaling Co. Ltd. and the Dundee Coal Co. Ltd.</i>
Prof. W. G. Sutton ..	<i>Principal, University of the Witwatersrand.</i>
Dr. H. J. van Eck ..	<i>Chairman and Managing Director, Industrial Development Corporation.</i>
Dr. R. W. Wilcocks ..	<i>Chairman of the University Advisory Council and former Rector of the University of Stellenbosch.</i>
Mr. J. E. Worsdale ..	<i>Chairman and Managing Director, White's S.A. Portland Cement Co. Ltd.</i>
Secretary/Treasurer ..	Mr. A. J. Miller-Smit, B.A., M.Com.

In die onderhawige tydperk is drie Raadsvergaderings gehou.

Die Raad maak met diep leedwese melding van die dood van twee van sy lede, nl. dr. E. T. Stegmann en prof. M. van den Ende. Dr. T. Alty en prof. S. F. Oosthuizen is in hulle plekke aangestel.

#### Ledelys en Vergaderings van die Uitvoerende Komitee

Onderstaande was op 31 Maart 1958 lede van die Komitee:

Dr. S. M. Naudé (*Voorsitter*)

Dr. F. J. de Villiers

Dr. P. J. du Toit

(met mnr. Worsdale, prof. H. O. Mönnig, prof. S. F. Oosthuizen en prof. W. G. Sutton as plaasvervangende lede vir sowel dr. de Villiers as dr. du Toit).

Die Uitvoerende Komitee het ses vergaderings gehou.

#### Navorsingsadviesliggame

Navorsingsadvieskomitees is aangestel vir Mediese en Tandheeldkundige Navorsing, Lugvaartkundige Navorsing, Bounavorsing, Chemiese Navorsing, Navorsing in verband met Meganiese Ingenieurswese, met Voeding, met Personeel, Fisiese Navorsing, benewens die Standaarderaad. Die Raad wil sy dank betuig aan die talle wetenskaplikes, ingenieurs en nyweraars wat hul tyd opgeoffer het om in hierdie nasionale advieskomitees te dien en tot die leiding in verband met hul werksaamhede by te dra.



*Prof. S. F. Oosthuizen.*



*Dr. T. Alty.*

During the period under review three meetings of the Council were held.

The Council wishes to record with deep regret the death of two of its members, namely, Dr. E. T. Stegmann and Prof. M. van den Ende. Their places were filled by the appointment of Dr. T. Alty and Prof. S. F. Oosthuizen.

#### Membership and Meetings of the Executive Committee

The membership of the Committee on 31st March 1958, was:

Dr. S. M. Naudé (*Chairman*).

Dr. F. J. de Villiers, Dr. P. J. du Toit

(with Mr. Worsdale, Prof. H. O. Mönnig, Prof. S. F. Oosthuizen and Prof. W. G. Sutton as floating alternates to both Drs. de Villiers and du Toit.)

The Executive Committee held six meetings.

#### Research Advisory Bodies

Research Advisory Committees were appointed for Medical and Dental Research, Aeronautical, Building, Chemical, Mechanical Engineering, Nutrition, Personnel, Physical, Road, Telecommunications and Water Research, in addition to the Standards Council. The Council wishes to express its thanks to the large number of scientists, engineers and industrialists who gave up their time to serve on these national advisory bodies and helped to guide their activities.



# Algemene Oorsig

## Opleiding en die Wetenskap

In onderstaande verslag sal dit blyk dat dieselfde tema herhaaldelik voorkom: daar is heelwat bereik, maar met voldoende personeel kon daar meer uitgerig gewees het. Namate dit al moeiliker word om opgeleide personeel in Suid-Afrika of oorsee te werf, skyn dit onvermydelik te wees dat navorsings- en standaardiseringswerk daar- onder moet ly of dat dit altans onmoontlik gaan word om baie van die nuwe projekte wat soveel by hulle hulp sou baat, aan te pak.

In feitlik elke Westerse land is daar heelwat oor die tekort aan wetenskaplikes en ingenieurs geskryf. Een van die onrusbarende kenmerke van hierdie wetenskaplike en tegniese hongersnood is dat dit skynbaar nie van verbygaande aard is nie. Dit lyk asof die probleem tweeledig is en sowel die opvoedingstelsel as die student self raak.

Begaaftheid kom nie so algemeen voor dat ons dit strafloos verlore kan laat gaan nie. Veels te veel van ons begaafde kinders maak te vroeg met hul opleiding klaar of verbeur die kans op hoër akademiese opleiding omdat hulle op skool toegelaat word om die maklikste keusevak te kies. Daar bestaan ongetwyfeld 'n behoefte aan beter leiding van ouerkant en 'n beter stelsel vir die vroeë herkenning en aanmoediging van bekwame studente.

Een van die grondgedagtes wat as spoorslag tot die oprigting van die W.N.N.R. gedien het, was die behoefte om vir wetenskaplikes in Suid-Afrika die geleentheid en die fasiliteite te skep om tot die ontwikkeling en eksploitasie van ons land se natuurlike hulpbronne by te dra. Te veel van ons begaafste navorsers is die land uit na groot navorsingsinrigtings in die buiteland, om nooit weer terug te keer nie. Dit verheug die Raad dat hy in die dertien jaar van sy bestaan, daartoe kon bydra om hierdie prosesse van intellektuele erosie teë te gaan. Met die voorsiening van voldoende ondersteuning vir navorsing aan die universiteite of, in toenemende mate, die instelling van laboratoriums vir nywerheidsnavorsing, het hy sy doel bereik. Baie van die jong wetenskaplikes wat aan die universiteite gewerf is, het sedertien gevorder tot gesaghebbende poste in die Raad se laboratoriums, terwyl ander tans betrekkings aan die Universiteite of in die nywerheid beklee.

Die sorgwekkendste aspek van die huidige toestand is die tekort aan begraaft jong wetenskaplikes wat opgelei kan word om die plek in te neem van die navorsers wat na hul gevorderde ondervinding in die Raad se laboratorium opgedoen, na die nywerheid en die universiteite getrek word. As die W.N.N.R. sulkes nie kan vind nie, kan hy een van sy belangrikste funksies nie nakom nie,

# General Review

## Education and Science

In the report that follows it will be found that the same theme recurs time and again; a great deal has been achieved, more could have been done had adequate staff been available. As it becomes increasingly difficult to recruit trained personnel from South Africa or from overseas it seems inevitable that the work of research and standardization will suffer, or at best that it will not be possible to undertake many of the new projects that would so greatly profit by their assistance.

Much has been written about the shortage of scientists and engineers in practically every country in the Western World. One of the most disturbing features of this scientific and technical famine is that it does not appear to be a passing phase. The problem seems to be a dual one, that of the educational system and of the student himself.

Talent is not so universal that it can be wasted with impunity. Far too many of our gifted children end their education too early, or miss the opportunity for higher academic training as the result of being allowed to choose the easy alternative subject at school. There is undoubtedly a need for better parental guidance and a better system for early identification and encouragement of able students.

One of the basic thoughts underlying the foundation of the C.S.I.R. was the need to create opportunities and facilities for scientists in South Africa to contribute to the development and exploitation of the country's natural resources. Too many of our most gifted research workers were leaving this country for the great research institutions abroad, never to return. The Council is pleased to find that, during the thirteen years of its existence, it has been able to play its part in checking this process of intellectual erosion. This has been achieved through the provision of adequate support for university research, or, to an increasing extent, by the growing number of industrial research laboratories. Of the young scientists recruited from universities many have since moved up to leading positions in the Council's organization, while others have gone on to take posts at universities or in industry.

The aspect of the present situation which now causes the gravest concern is the shortage of gifted young scientists who can be trained to take the place of the research workers drawn off by industry and the universities after gaining advanced experience in the Council's laboratories. Unless they can be found, the C.S.I.R. will not be able to fulfil one of its most important functions,





*Die hoofleeskamer van die W.N.N.R.-biblioteek wat ten dienste is van wetenskaplikes oral in Suid-Afrika.*

*The main reading room of the C.S.I.R. Library which serves scientists throughout South Africa.*

naamlik as kweekskool en bron van navorsers vir die nywerheid.

Dit is 'n probleem wat skynbaar nie maklik opgelos kan word nie. Daar bestaan 'n steeds groeiende behoefte om ons onderwysstelsel in oënskouw te neem en deur ontleding en erkenning van sy swakhede, sy sterkte te vind en dit as grondslag te laat dien. Op 'n breër vlak bestaan daar veral 'n behoefte om 'n groter eerbied vir die opvoeding, 'n groter agting vir intellektuele prestasie en 'n groter besef van die wesenlike belangrikheid van die onderwys vir die voortbestaan van ons demokratiese lewenswyse in die openbare gewete te laat posvat. Op 'n enger vlak het dit nodig geword om ons onderwysstelsel so te hersien dat hy daarvoor sal sorg dat geen talent misken en onontwikkel bly nie. Dit geld veral die wetenskap en tegnologie, waar die behoeftes van 'n bedryf wat in die behoeftes van veertien miljoen voorsien, uit 'n bevolking van drie miljoen getrek moet word.

Tensy die vraagstuk opgelos word en die W.N.N.R. en die nywerheid word van 'n gestadige stroom personeel voorsien wat opgelei is om navorsingswerk te onderneem, sal Suid-Afrika mank gaan aan een van die grondpilare waarop sy toekomstige ontwikkeling rus.

namely, that of a training ground and reservoir of industrial research workers.

It is a problem for which there appears to be no easy solution. There is a growing urgency for the need to take stock of our educational system and to build upon its strengths by analysing and acknowledging its weaknesses. Above all, from the broader viewpoint, there is a need to build into the public conscience a greater respect for education, a greater esteem for intellectual achievement, and a greater appreciation of the crucial importance of education to the very survival of our democratic way of life. From the narrower point of view it has become necessary to revise our educational system so as to ensure that there is no opportunity for talent to go unrecognized and undeveloped. This is particularly the case in respect of science and technology, where the needs of an industry serving fourteen million people must be met from a population of three million.

Unless the problem can be solved and a steady flow of research-trained personnel made available to the C.S.I.R. and industry, one of the basic supports on which the future development of South Africa rests will be lacking.



### Chemiese Navorsing

Ons land se navorsing in verband met waterontsouting deur middel van elektrodialise het in die buiteland heelwat belangstelling gaande gemaak en van diegene wat belang stel, is daar baie wat meen dat die inligting verkry uit die werking van die waterontsoutingsinstallasie, ontwerp deur die W.N.N.R., en wat deur 'n groep mynmaatskappye by die Vrystaatse Geduldmyne te Welkom opgerig word, die eerste betroubare leidraad gaan verskaf oor die uitvoerbaarheid van elektrodialise op wesenlike groot skaal. Hierdie installasie lewer 'n maksimum van twee-en-'n-halfmiljoen gelling per dag.

Met die rivieropnames wat in die jaar gemaak is, het die ondersoek 'n baie breë oewergebied beslaan. 'n Uitgebreide versamelingsprogram van chemiese, biologiese en bakteriologiese besonderhede en gegewens oor die vloei is ingestel, benewens 'n laboratoriumstudie van die chemiese en biologiese reaksies wat in watermassas en riviermodder plaasvind. Die opnames beoog die beste gebruikmaking van Suid-Afrika se waterbronne in die toekoms en om besoedeling te kontroleer namate industrialisasie uitbrei.

In samewerking met die Enologiese Navorsingsinstituut van die Departement van Landbou, het die Nasionale Chemiese Navorsingslaboratorium 'n Wynnavorsings-



*A Jenkins sampler being used in the study of bottom sediments in rivers and dams.*

*'n Jenkinsmonsterneemer word vir die ondersoek van neerslae in damme en riviere gebruik.*



*Bepaling van werkverrigting van 'n windmeule.*

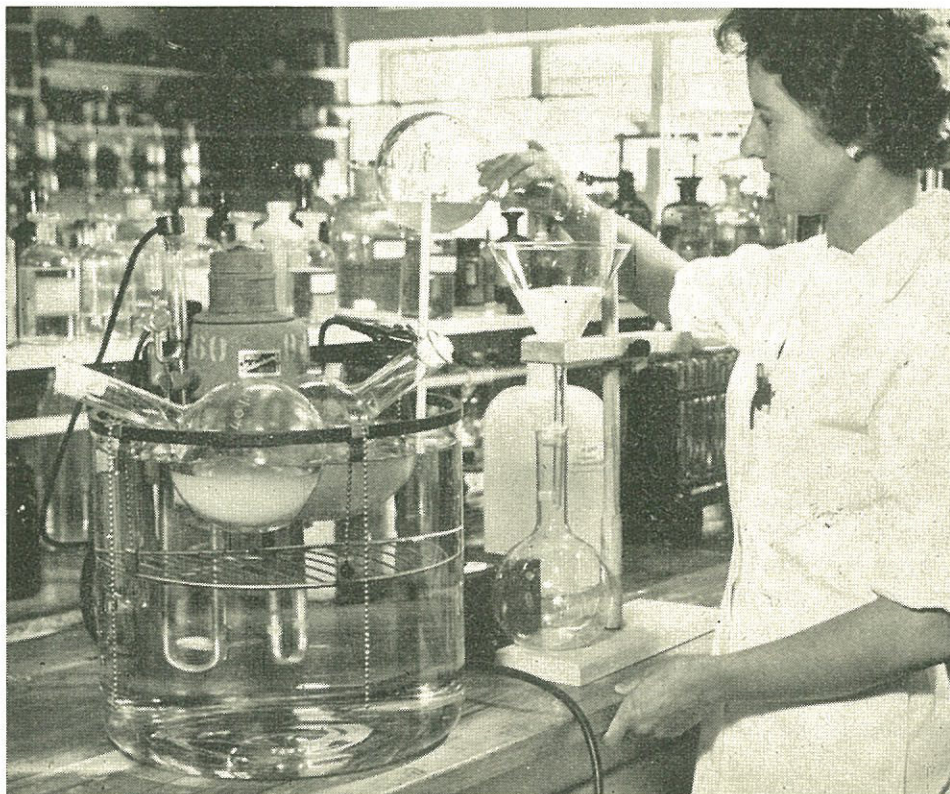
*Performance testing of a windmill.*

### Chemical Research

South African research into water demineralization by electro dialysis has aroused a great deal of interest overseas, and many of those interested are of the opinion that the information derived from the operation of the water desalting plant designed by the C.S.I.R. and being erected by a group of mining companies at the Free State Geduld mine at Welkom will provide the first reliable guide to the feasibility of electro dialysis on a really large scale. This plant has a capacity of two and a half million gallons per day.

River surveys, continuing during the year, entailed the investigation of rivers along a very broad front while involving a comprehensive programme of collecting chemical, biological and bacteriological information and flow data, in addition to conducting laboratory studies on the chemical and biological reactions that occur in bodies of water and river mud. The purpose of these surveys is to enable the best future use to be made of South Africa's water resources and to check on pollution as industrialization expands.





*Die toets van die diastatiese gehalte van 'n graanmout wat vir die vervaardiging van kafferbier gebruik word.*

*The testing of the diastatic quality of a malt used for making kaffir beer.*

eenheid te Stellenbosch opgerig, met die hoop dat ondersoek van die oorsake van biotiese troebelheid 'n ernstige probleem by Suid-Afrikaanse wyn sal oplos. Betekenisvolle resultate is reeds verkry en 'n studie word gemaak van die giste wat geïsoleer is om vas te stel waarom hul voorkoms in die plaaslike troebel wynsoorte soveel hoër as in Franse wynsoorte is. Die Nasionale Kankervereniging het nog steeds sy steun verleen by die werk in verband met die chemiese meganisme van karsinogenese, wat in samewerking met die W.N.N.R. se Voedingnavorsingseenheid aan die Universiteit van die Witwatersrand voortgesit is.

In die loop van die ondersoek van huidkarsinogenese is sekere verskille tussen die vel van muise en dië van rotte waargeneem, wat gebruik sal word om nuwe proewe te beplan waardeur die muis se gewone vatbaarheid vir hierdie siekte gewysig kan word. Interessant is dit om waar te neem hoe die mediese navorsing in groeiende mate op die nie-biologiese wetenskappe steun. Liggaamschemie, radioisotope en die gebruik van ingewikkelde instrumente kan as voorbeelde dien van die chemiese en fisiese tegnieke wat vir die hedendaagse mediese navorser onontbeerlik is.

Working in co-operation with the Oenological Research Institute of the Department of Agriculture the National Chemical Research Laboratory has established a Wine Research Unit at Stellenbosch. By investigating the causes of biotic turbidity it is hoped to solve a serious problem in South African wines. Highly significant results have already been obtained and a study of the yeasts isolated is being undertaken to discover why their incidence is so much higher in local turbid wines than in French wines.

Work on the chemical mechanism of carcinogenesis continued to receive the support of the National Cancer Association and was carried out in collaboration with the joint C.S.I.R. Nutrition Research Unit at the University of the Witwatersrand. During the investigation of skin carcinogenesis certain differences between rat and mouse skin were noted and will be used to devise new tests to modify the ordinary susceptibility of mice to this disease. It is interesting to observe the increasing dependence of medical research on the non-biological sciences. Body chemistry, radioisotopes and complicated instrumentation can be quoted as being among the chemical and physical techniques essential to the present day medical researcher.



### Fisiese Dienste

Moeilikhede wat aanvanklik in verband met die siklotron ondervind is, is gedurende die jaar uit die weg geruim en verbeterings aan 'n hele paar van sy onderdele het aansienlik bygedra tot die bestendige werking daarvan.

In Desember 1957 is die isotoopafskeier aanvanklik gemonteer. As proefneming is die isotoopbestanddele van verskeie elemente afgeskei en het die uiters bevredigende resultate bewys dat hierdie isotoopafskeier goed vergelyk met die beste in sy soort, wat die wêreld oplewer.

Die elektromeganiese opnamestelsels in Suid-Afrikaanse geregshowe deur die Akoestiese Afdeling opgerig, is verder uitgebrei. Twee stelsels is ontwikkel en vir hooggeregshowe in die Federasie geïnstalleer. Argitekte en nyweraars het die laboratorium gereed in verband met die akoestiese ontwerp en verbetering van geboue geraadpleeg. Verder het die laboratorium in verband met die nuwe Volksraadgebou te Windhoek, met kerke, hofsale, teaters en vergadersale raad gegee.

'n Geslaagde nuwe onderneming was 'n tweeweekse rondreis, na die vernaamste kusdorpe, Sasolburg en Bulawayo, van drie lede van die Nasionale Fisiese Laboratorium en 'n lid van die Buro vir Standaard. Die lede het lesings gehou oor die toepassing van radio-

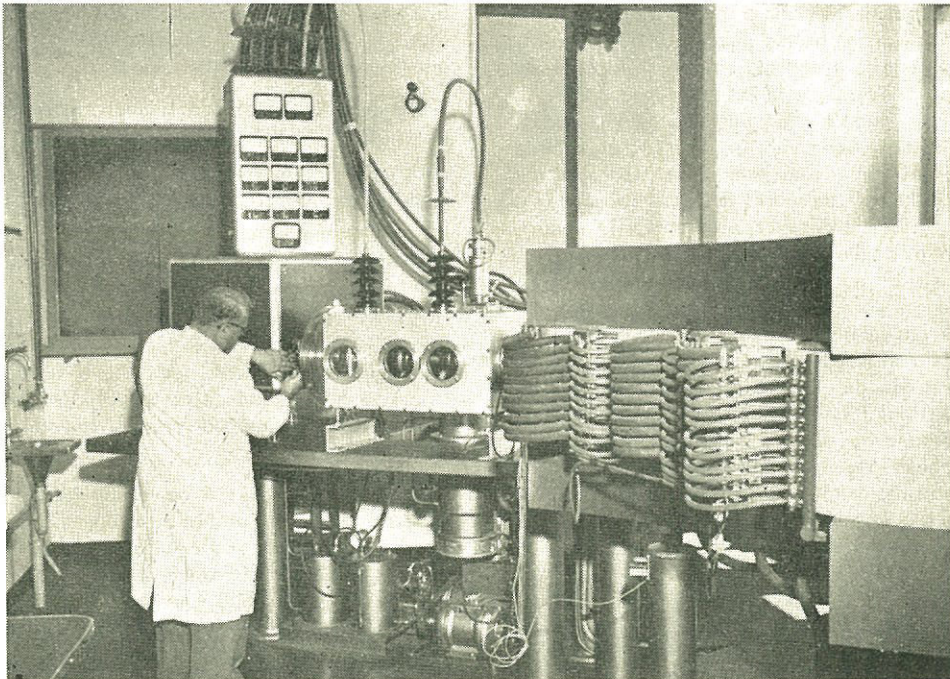
### Physical Services

Initial difficulties in connection with the cyclotron were successfully overcome during the year and improvements to several of the basic components contributed considerably to stability of operation.

December, 1957, saw the first assembly of the isotope separator. To test it, separations of different elements into their isotope components were carried out, the eminently satisfactory results indicating that this isotope separator can compare with the best of its type anywhere in the world.

The electro-mechanical recording systems in South African Law Courts established by the Acoustics Division were further extended, two complete systems being developed and installed for Supreme Courts in the Federation. The Laboratory was regularly consulted by architects and industrialists on the acoustical design and correction of buildings, advice being given on the new House of Assembly in Windhoek, churches, court rooms, theatres and assembly rooms.

A successful innovation was the two-week tour of the main coastal towns, Sasolburg and Bulawayo by three members of the National Physical Laboratory and a member of the Bureau of Standards, when lectures were given on the application of radio-activity in industry and interested firms were visited.



*Die isotoopafskeier wat gedurende die jaar voltooi is, is 'n belangrike byvoeging tot die Raad se kernnavorsingsfasiliteite.*

*This isotope separator completed during the year is an important addition to the Council's nuclear research facilities.*



aktiwiteit in die nywerheid en firmas wat belang stel, besoek.

Dat die instelling verlede jaar van 'n Onderafdeling Ontploffingsgevaar van die Afdeling Fisika van die S.A.B.S. waar waaiers, motors, steenkoolsae, bore en plowers getoets word vir geskiktheid vir gebruik in brandgasmyne, ruimskoots geregverdig is, bewys die hoeveelheid werk wat die onderafdeling reeds verrig het en die belang wat die Staatsingenieur se Hoofinspekteur van Masjinerie blykbaar daaraan heg. Namate hierdie aspek van veiligheid in die myne meer beklemtoon word, neem die aantal aansoeke om vlamdigtheidstoetse toe.

Die ses fabrikante met permitte om die S.A.B.S.-merk op hul weerkaatsers vir motorvoertuie te gebruik, het in die onderhawige tydperk altesame 3½ miljoen stelle geproduseer. Sommige van die weerkaatsers wat in die Unie vervaardig is, is volgens proewe beter as die beste ingevoerdes wat getoets is.

### **Meganiese Ingenieurswese**

Snelle ontwikkeling van die nywerheid in 'n jong land bring sowel probleme as voordele mee. In die verslagjaar is talle van die probleme van werktuigkundige aard vir oplossing met behulp van navorsing aan die Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese voorgelê. Van die instituut se nege onderafdelings het vyf feitlik voltyds onder kontrak vir die nywerheid gewerk. Hulle het nie alleen besondere vervaardigingsprobleme aangepak nie, maar ook getrag om, met behulp van navorsingsbeurse onder kontrak deur die betrokke nywerhede toegeken, antwoorde te vind op vraagstukke wat nywerhede in hul geheel beïnvloed.

Die onlangs ingestelde Foundry Sands Fellowship, waartoe 'n aantal nywerhede bydra, is 'n goeie voorbeeld van hierdie werk. In hierdie geval sal die eienskappe van verskeie beskikbare sandsoorte bestudeer word en 'n ranglys vir geskiktheid vir gieters opgestel word. 'n Soortgelyke beurs met behulp waarvan die beste ontwerp vir houtkissies vir die verpakking en verskeping van sitrusvrugte bestudeer word, word enige jare reeds bestee. Dit vul die werk van die Buro i.v.m. die standaardisering van plankies vir sitruskassies aan en dien as voorbeeld van die voordele wat vir die nywerheid kan voortvloei, uit noue samewerking tussen navorsing en standaardisering.

Mynontginning op steeds toenemende dieptes bring heelwat probleme mee, waarvan die voorkoms van rotsuitbarstings in die delfplekke van diep myne onder die ernstigstes tel. In samewerking met die Kamer van Mynwese van Transvaal en die Oranje-Vrystaat en die Nasionale Fisiese Navorsingslaboratorium, het die Navorsingsinstituut vir Meganiese Ingenieurswese navorsingswerk gedoen met die oog op 'n beter begrip van die verskynsel van rotsuitbarstings en beplanning van metodes om hulle te voorkom of ten minste om die voorkomsyfer en strafheid daarvan te verlaag.

Die Instituut onderneem verder werk wat die lewe van ons hele land raak, o.a. die studie van erosie en die

The establishment of a Flameproof Section of the Physics Division of the S.A.B.S. last year, in which fans, motors, coal cutters, drills and shot exploders are tested for their suitability for use in fiery mines, was amply justified by the amount of work handled and by the apparent importance attached to it by the Government Engineer's Chief Inspector of Machinery. As growing emphasis is laid on this aspect of mining safety, the number of requests for flameproof tests correspondingly increase.

The six manufacturers with permission to use the S.A.B.S. mark on their reflectors for motor vehicles between them produced 3½ million units during the period under review. Some of the reflectors produced in the Union proved superior to the best imported units tested.

### **Mechanical Engineering**

The rapid growth of industry in a young country brings problems as well as advantages in its train. Many such problems of a mechanical nature were brought to the National Mechanical Engineering Research Institute for solution by way of research during the year under review. Five of the nine sub-divisions of the Institute worked almost full time on contract work for Industry, tackling not only individual manufacturing problems but attempting, with the aid of research contract fellowships sponsored by the relevant industries, to find answers to questions that affect entire industries.

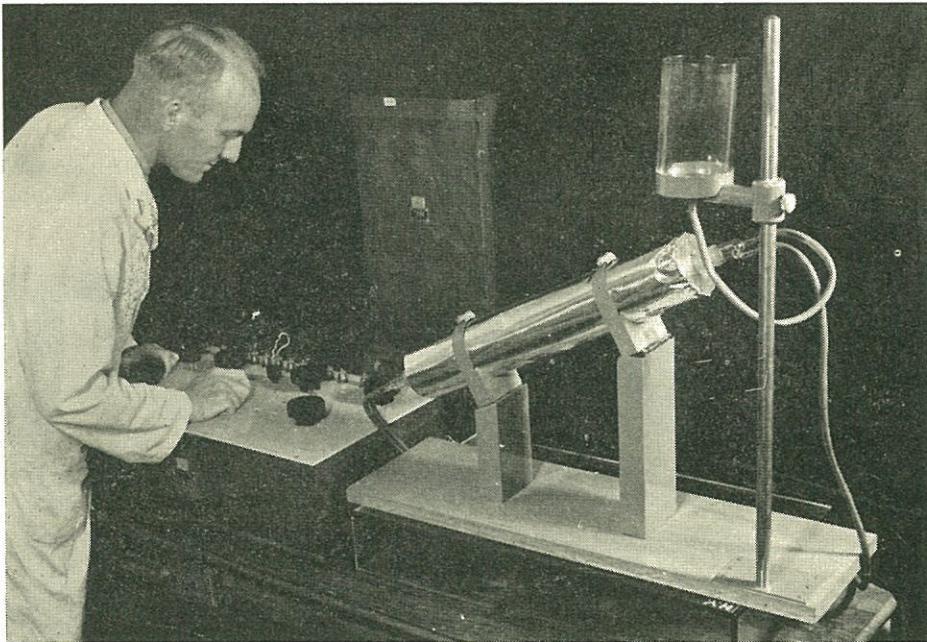
The recently established Foundry Sands Fellowship to which a number of industries subscribe is a good illustration of this work. In this case a study will be made of the properties of various available sands and their order of suitability for casting will be determined. A similar fellowship for the purpose of establishing the best design for wooden boxes for packing and shipping citrus has been in operation for some years. This supplements the work of the Bureau of Standards on the standardization of shooks for citrus boxes and demonstrates the benefits to industry that can be brought about by close collaboration between research and standardization.

The mining of gold at constantly increasing depths creates a number of problems, among the more serious being the occurrence of rockbursts in the working stopes of deep level mines. In collaboration with the Transvaal and Orange Free State Chamber of Mines and the National Physical Research Laboratory, research was done by the National Mechanical Engineering Research Institute with the aim of achieving better understanding of the phenomenon of rockbursts, and of devising methods for their possible prevention, or at least, of decreasing their incidence and severity.



toeslik van riviere en hawens, van gasturbines met steenkool as brandstof en van verkoelingstelsels wat met sonenergie aangedryf word. Wat die turbine met steenkoolasbrandstof betref, sou 'n oorspronklike beweging van die aard, indien dit met welslae ontwikkel word, bepaald van groot ekonomiese belang kan wees in gebiede waar die gebrek aan voldoende watervoorrade die oprigting van gewone stoomaangedrewe kragstasies uit-skakel. Die steenkoolgasturbine wat op die enkelvoudige siklus werk, het geen water daarvoor nodig nie en ontwikkel elektrisiteit teen 'n koste wat gunstig met die van stoominstallasies vergelyk. Met die oog hierop lyk die soort turbine uiters geskik vir die ontwikkeling van die nywerheid en die mynwee in gebiede waar water skaars is maar waar 'n groot toevoer goedkoop krag beskikbaar is.

The Institute is also undertaking work that has a bearing on the life of the whole country, *inter alia*, studies on erosion and the silting up of rivers and harbours, on coal burning gas turbines, and on solar operated refrigeration systems. In respect of the coal fired gas turbine project it may be said that if such prime movers could be successfully developed they could be of great economic importance in areas where the lack of sufficient water supplies rules out the erection of ordinary steam type power stations. The coal burning gas turbine operating on the simple cycle requires no water for its operation and will generate electricity at a cost which compares favourably with steam plants. In view of this it appears eminently suitable for the development of industry and mining in areas where water is scarce but where a large supply of cheap power is required.



*'n Nuwe instrument wat vir die akkurate meting van lugvogtigheid ontwikkel word.*

*A new instrument being developed for the accurate measurement of the humidity of the air.*

### Telekommunikasie

In die onderhawige tydperk is 'n besonder interessante projek aangepak, naamlik die waarneming van die eerste kunsmatige satelliet op sy baan, met behulp van radio. Aangesien die Russe hierdie satelliet sonder voorafgaande waarskuwing gelanseer het, is 'n radiowaarnemingstelsel onmiddelik geïmproviseer met reeds bestaande toerusting waarmee die baan binne 'n paar dae ruweg vasgestel kan word. Die waarnemings is voortgesit totdat die satelliet se sender geswyg het en teen die tyd was die baan reeds taamlik akkuraat bepaal.

### Telecommunications

A project of unusual interest undertaken during the period under review was the improvised radio tracking of the first artificial satellite. As the Russians established this satellite without previous specific warning, a radio tracking system was immediately improvised with existing equipment which enabled the orbit to be roughly determined within a few days. Observations continued until the satellite's transmitter failed, by which time the orbit had been determined with a considerable degree of accuracy.



Die „Tellurometer“-instrumente wat in samewerking met die W.N.N.R. in Kaapstad deur Tellurometer (Pty.) Limited vervaardig word, het reeds dwarsdeur die wêreld soveel bekendheid verwerf, dat hulle tot in die Verenigde State, Europa, Australasië, Kanada, Japan, Indië en verskeie Suid-Amerikaanse lande verkoop is. In April 1957 is 'n reeks metings aan die landmeetkundige basis te Ridgway in die suide van Engeland uitgevoer, waar die toestel met welslae tydens die gekontroleerde toetse onder toesig van die United Kingdom Ordnance Survey aan sy spesifikasie voldoen het. As bewys van die gewildheid en praktiese nut van die instrument dien 'n artikel in 'n Amerikaanse padbouydskrif wat meen dat die gebruik daarvan vir die Verenigde State se padbouwerk by die voorlopige opnames 'n besparing van 'n miljoen dollar beteken.

Deur middel van akkurate metings by die Ridgway-basis en driehoeksmeting van die omgewing is 'n akkurate bepaling gedoen van die snelheid van radiogolwe, wat 'n waarde opgelewer het wat voortaan met vrymoedigheid in „Tellurometer“-werk gebruik kan word.

#### Elektriese Standaardisering

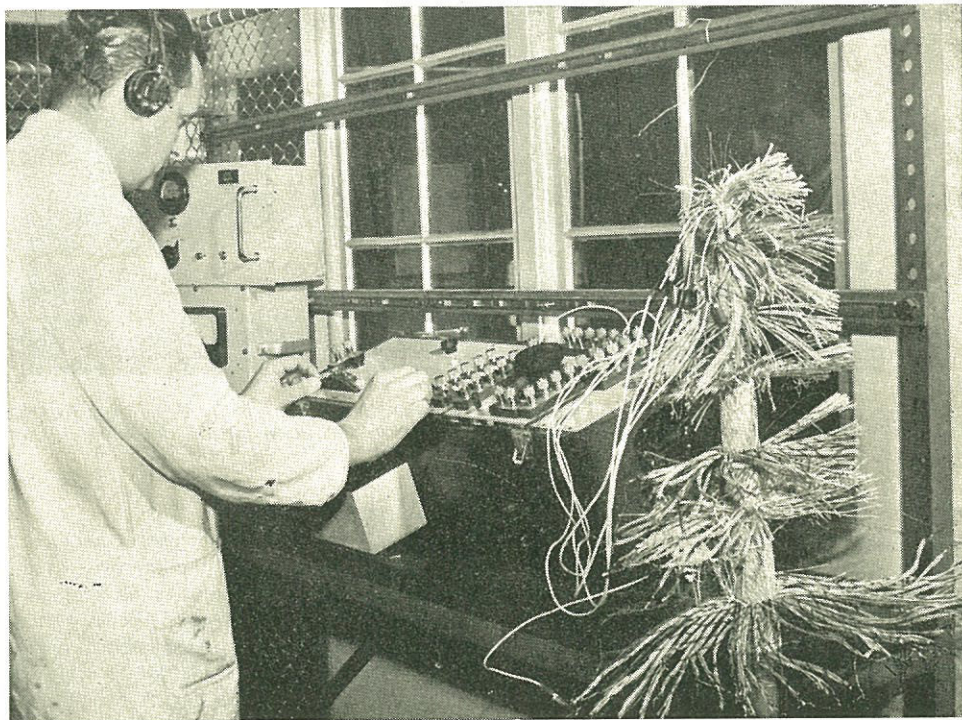
Oor die algemeen het al die elektriese standaardisering wat tot nog toe in die Unie uitgevoer is, so ver moontlik

The “Tellurometer” instruments manufactured in Cape Town by Tellurometer (Pty.) Ltd., in conjunction with the C.S.I.R., have become so well known throughout the world that they have been sold as far afield as the United States, Europe, Australasia, Canada, Japan, India and several South American countries. A programme of measurements was carried out in April, 1957, at the Ridgway geodetic base in the south of England, when the instrument successfully met its specification under the controlled tests supervised by the United Kingdom Ordnance Survey. Proof of the instrument's ready acceptance and its practical application comes in the form of an article in an American road construction magazine which claims that savings in the United States highway programme from its use in the preliminary surveys will amount to a million dollars.

An accurate determination of the velocity of radio waves was made by means of extensive measurements at the Ridgway base and surrounding triangulation, thereby obtaining a value that can be confidently used in future “Tellurometer” work.

#### Electrical Standardization

Generally speaking, all the electrical standardization so far carried out in the Union has conformed as far as



*Telefoonkabels wat in Suid-Afrika vir uitvoer vervaardig word, word getoets.*

*Testing of telephone cable made in South Africa for export.*



aan internasionale vereistes voldoen. Die tyd het aangebreek om die hele Afrika as potensiële mark vir Suid-Afrika te beskou en die handel met ander lande van Afrika moet op allerlei wyses so maklik moontlik gemaak word. 'n Goeie voorbeeld van hierdie beleid is die pogings wat aangewend is om die plaaslike elektrotegniese nywerheid te beweeg om die Internasionale Elektrotegniese Kommissie se aanbevelings ten opsigte van die standaardisering van die groottes vir induksiemotorrame te aanvaar.

Die neiging tot bedryfsvereenvoudiging deur 'n uitgebreider toepassing van standaarde is miskien die belangrikste rigting wat hom in die afgelope jaar in die elektrotegniese nywerheid in Suid-Afrika openbaar het. 'n Goeie voorbeeld hiervan is die bedryf vir die vervaardiging van elektriese kokers, waarin al die onderdele soos byvoorbeeld skakelaars, termostate, kookplate en draadwerk deur afsonderlike standaarde gedek word. Langsamerhand word afmetingstandaarde ook ingevoer, wat nie alleen die nywerheid self nie, maar ook onderhoud- en reparasiewerk verder sal vereenvoudig. Blykens die lewendige belangstelling vir 'n standaardspesifikasie wat tans opgestel word, waarin baie standaardeienskappe voorgeskryf word wat vereenvoudiging en derhalwe verlaagde koste in die hand sal werk, brei hierdie neiging hom ook tot die transformatorbedryf uit.

Ten opsigte van die hoogspanningsisolators wat in die Unie gemaak word, het daar interessante ontwikkelings plaasgevind. Die Buro vir Standaarde se Afdeling Elektrotegniese Ingenieurswese het met behulp van hoogspannings- en stootspanningstoetse die nywerheid te hulp gekom en hy is vol vertroue dat hy binne afsienbare tyd in meeste van die behoeftes van die land op die gebied sal kan voorsien.

Sedert die Nasionale Fisiese Navorsingslaboratorium sy nuwe perseel op die nuwe terrein naby Brummeria betrek het, is die instandhouding van die nasionale standaard vir spanning en vir weerstand, weens beter werkrumte en betroubaarder temperatuurbeheer heelwat vereenvoudig.

### **Bouwerk en Siviele Ingenieurswese**

Daar het 'n opvallende belangstelling in die ontwerp van geboue vir die verskillende klimate wat in Afrika aangetref word, ontstaan, en in die Unie sowel as in ander gebiede in Afrika word steeds meer moeite gedoen om navorsing in hierdie rigting te bevorder. 'n Lid van die personeel van die Nasionale Bounavorsingsinstituut het verlede September 'n Inter-Afrikaanse Vergadering van Deskundiges in Lagos bygewoon om die tegniese probleme wat uit die lewe in die trope en subtropie voortspruit, met inbegrip van vraagstukke in verband met bouwerk en behuising, te bespreek. Hierdie vergadering het ook die geleentheid gebied om werk in verband met die invloed van die klimaat op die lewens- en werktoestande binnenshuis, waarvan al 'n hele paar jaar 'n studie in die Instituut gemaak is, te bespreek.

possible to international requirements. The time has come to look upon the whole of Africa as a potential South African market and trade with other African countries must, in every way, be made as easy as possible. The efforts made to persuade the local electrical industry to accept the International Electrotechnical Commission's recommendations for the standardization of frame sizes of induction motors provide a good illustration of this policy.

Perhaps the most significant trend in the South African electrical engineering industry during the past year has been that towards industrial simplification by the wider use of standards, a good example being the electric cooker industry in which all the components such as switches, thermostats, cooking plates and wires are covered by individual standards. Dimensional standardization is gradually being introduced and will result in further simplification, not only in the industry itself but also in maintenance and repair. This trend is also extending to the transformer industry judging by the keen interest being shown in a standard at present being prepared which will include many standardizing features leading to simplification and consequently, to lowered costs.

Developments in the high voltage insulators made in the Union have been interesting. Help has been given to this industry by the Bureau of Standards' Electrical Engineering Division by way of high voltage and impulse tests, and it is confidently anticipated that within a short time it may be in a position to supply most of the country's requirements.

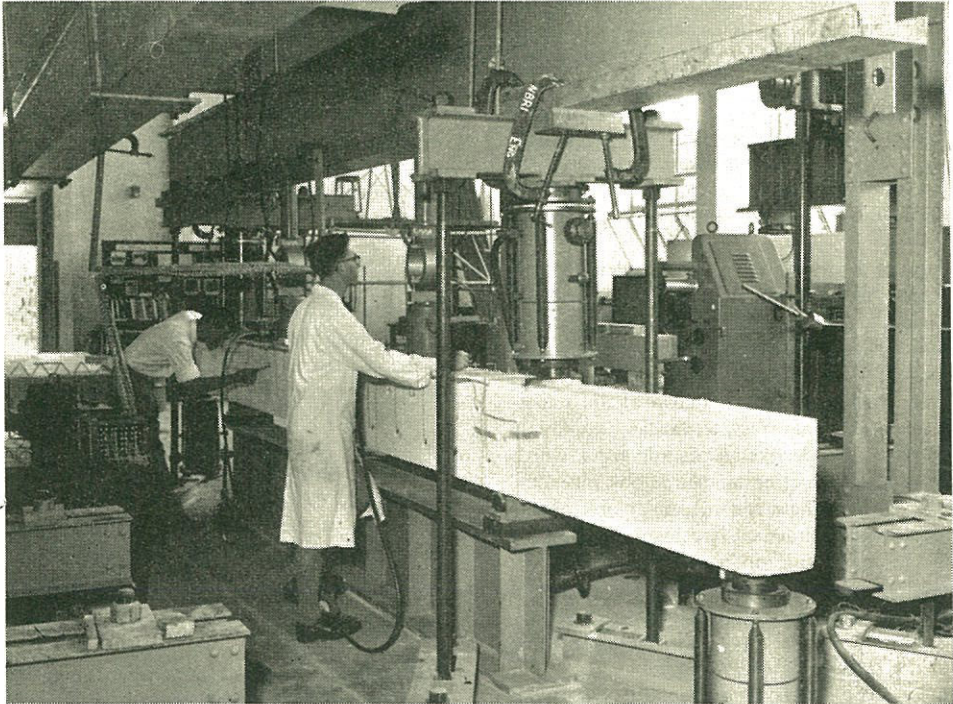
As a result of more adequate space and of the greater reliability of the temperature control, the maintenance of the national standards of voltage and resistance has been considerably simplified since the National Physical Research Laboratory moved into its new quarters at the New Site near Brummeria.

### **Building and Civil Engineering**

Interest in building design for African climates has become very marked and greater efforts are being made in the Union and other territories to foster research in this direction. A member of the staff of the National Building Research Institute attended an Inter-African Meeting of Specialists held in Lagos last September, to consider the technical problems of living in the tropics and sub-tropics, including problems relating to building and housing. This meeting provided an opportunity for discussing work done on the effects of outdoor climate on indoor living and working conditions, which has been studied at the Institute for a number of years.

Contributions were also made by the Institute to a Symposium on Design for Tropical Living, which was





*Belastingstoets van 'n gewapende betonbalk tydens 'n fundamentele ondersoek van skuifspanning.*

*Loading test on a reinforced concrete beam in the course of a fundamental investigation into shear strength.*

Bydraes is ook deur die Instituut gelewer tydens 'n Simposium oor Ontwerp vir die Lewe in die Trope wat in Oktober in Durban gehou is en wat gesamentlik deur die Natalse Streeksnavorsingskomitee van die W.N.N.R. en die Universiteit van Natal gefinansier is. Die kommentaar en versoeke om inligting wat sedert hierdie vergadering ontvang is, is 'n duidelike bewys dat die simposium heelwat belangstelling dwarsdeur die Unie sowel as in ander lande gewek het.

Hospitaalnavorsing het waardevolle statistiese besonderhede aan die lig gebring in verband met die afstande deur verpleegsters tydens hul werkure afgelê, en die besparing van tyd en energie waartoe beter beplanning van die beskikbare ruimte sou kan lei. Dit het geblyk dat die polikliniek in Meadowlands, wat nou voltooi en in gebruik geneem is, tot sowat 35 persent verligting van die moederhospitaal gelei het en 'n skatting van die gemeenskap se behoefte aan hospitaalbeddens gebaseer op die verhouding tussen polikliniekpasiënte wat vir opname na die hospitaal verwys is, en die totale bevolking waarvoor die polikliniek bestem is, moontlik maak. Vir hierdie werk was dit nodig om 'n uitvoerige studie van die organisasie van hospitale en hulpdienste te maak, en dit sal moontlik verreikende gevolge hê, nie alleen op die ontwerp van hospitale nie, maar ook op die organisasie van geneeskundige dienste oor die algemeen.

held in Durban in October and sponsored jointly by the Natal Regional Research Committee of the C.S.I.R. and the University of Natal. From comments and requests for information received since this meeting it is evident that the symposium aroused considerable interest throughout the Union and in other countries.

Hospitals research disclosed some valuable statistical information in connection with a nurse's journeys during duty periods and the economy of time and energy that better planning of available space could bring about. The Meadowlands polyclinic, now completed and working, was found to effect a relief of about 35 per cent on the parent hospital and to permit of the assessment of the community's demand for hospital beds on the basis of the ratio of polyclinic patients referred to the hospital for admission, to the total population served by the polyclinic. This work has involved a detailed study of the organization of hospitals and auxiliary services and may have far-reaching effects, not only on the design of hospitals, but on the organization of medical services generally.

An experimental high school, Lyttelton-hoërskool, was designed in accordance with the School Buildings Committee's recommendations. This work indicated that with



'n Eksperimentele hoërskool, die Lyttelton-hoërskool, is volgens die Skoolgebouekomitee se aanbevelings ontwerp. Hierdie werk het aan die lig gebring dat met 'n gegewe onderwysoppervlakte, die hele oppervlakte van die skoolgebou aanmerklik verminder kon word en dat heelwat van die oppervlakte wat nie direk vir onderwysdoeleindes gebruik word nie, heeltemal uitgelaat of verminder kon word. Die eksperimentele laerskool te Waterkloof, Pretoria, is gebou en betrek, en dit het gebyk dat die koste heelwat laer was as dié van skole wat onlangs in Transvaal gebou is en net soveel kinders kon huisves. Die bevindings van die Skoolgebouekomitee staan in die vorm van 'n reeks van ses publikasies ter beskikbaarheid van argitekte.

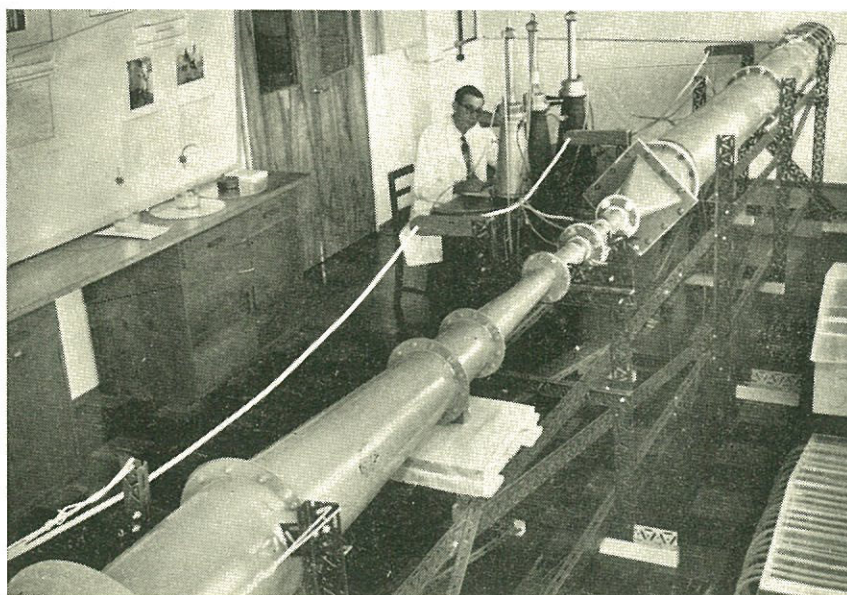
'n Standaardspesifikasie vir boukalk deur die Buro vir Standaarde uitgegee, was grotendeels gebaseer op die navorsingswerk deur die Instituut gedoen en behoort baie daartoe by te dra om die gebruik van kalk wat uit maklik verkrygbare Suid-Afrikaanse grondstowwe geproduseer kan word, te bevorder.

Die Stadsraad van Port Elizabeth wat verlede jaar die toesig oor die vervaardiging van pype vir die tweede stadium van die Port Elizabethse Watervermeerderingskema aan die Afdeling Siviele Ingenieurswese van die Buro vir Standaarde opgedra het, het daardie Afdeling versoek om ook toesig tydens die derde stadium van die skema te hou. Die Stadsraad skyn baie tevrede met die werk te wees wat hulle beskou as 'n soort versekering van die geld wat hulle in die vervaardiging van die pype belê het.

a given teaching area, considerable reductions could be made in the overall area of the school building and much non-teaching space could be either eliminated or reduced. The experimental primary school at Waterkloof, Pretoria, was built and occupied, its cost proving a great deal lower than that of schools of similar scholar capacity recently built in the Transvaal. The findings of the School Buildings Committee are available to architects in the form of a series of six publications.

A standard specification for limes for use in building, published by the Bureau of Standards was largely based on the research carried out by the Institute, and should do much to promote the use of limes manufactured from readily available South African raw materials.

The Port Elizabeth City Council which, last year, appointed the Civil Engineering Division of the Bureau of Standards to supervise the manufacture of the pipes used in Stage II of the Port Elizabeth Water Augmentation Scheme, has requested the Division to continue this supervision through Stage III of the Scheme. The City Council appears to be very satisfied with these services which it views as a form of insurance on the investment made in the manufacture of the pipes.



'n Windtonnel vir die bestudering van die stroming van lug deur vensteropeninge.

Wind tunnel for the study of air flow through window openings.



## Vervoer

Die vermeerderde kennis omtrent die gedrag van verskillende soorte paaie onder verkeer het duidelik laat uitkom hoe belangrik dit is om kortstondige vervormings van die struktuur deur swaar voertuie veroorsaak, waar te neem. By hul navorsing in verband met grondmeganika en padfondamente het die Nasionale Padnavorsings-instituut gedurende die verslagjaar die skuifvastheid van onversadigde grondsoorte onder verskillende vogtigheidstoestande ondersoek, en die spannings wat in die verskillende padlae ontstaan as gevolg van vasstamping of oppervlakbelasting is noukeurig nagegaan. Hopelik sal die gesamentlike veld- en laboratoriumondersoeke lei tot 'n meer rasonale ontwerp van padfondamente geskik vir Suid-Afrikaanse toestande.

Die eerste fase van die langtermynondersoek in verband met die koste van padkonstruksie en onderhoud is voortgesit. Inligting is in so'n volgorde en in soveel besonderhede versamel dat die padowerhede, na gereken word, die meeste onmiddellike voordeel daaruit sal kan trek.

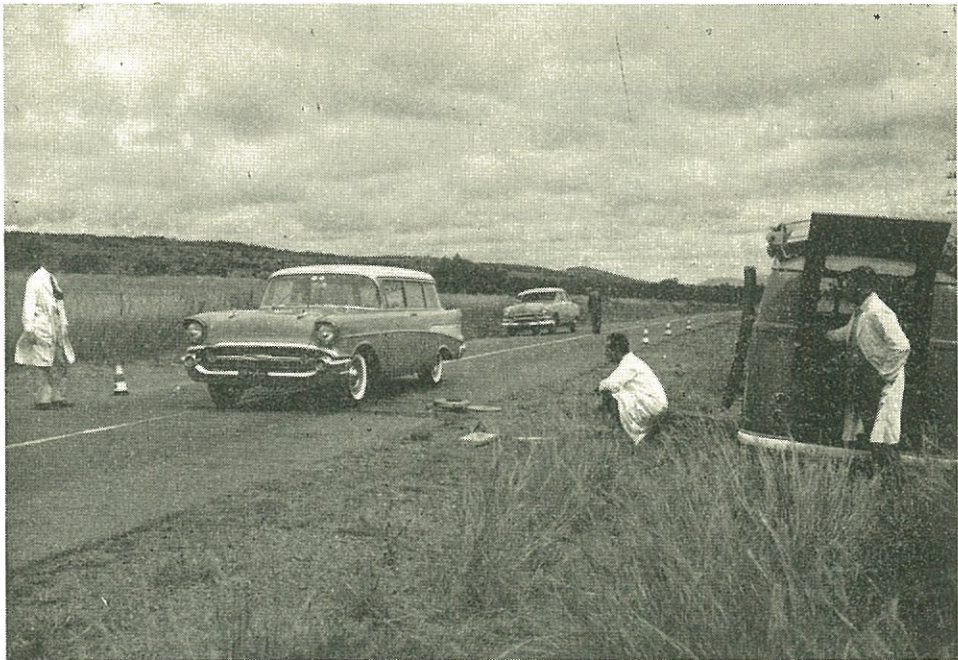
'n Ontleding van besondere belang was die van padongelukke oor 'n tydperk van ag jaar, met spesiale verwysing na die tyd van die dag en die dag van die week. Die bevinding dat twee maal soveel ongelukke gedurende die middagspitsuur as gedurende die oggendspitsuur voorgekom het, skyn daarop te dui dat die bestuurdersvermoeidheidsfaktor 'n belangrike rol by die voorkoms van padongelukke speel.

## Transport

Advances in knowledge of the behaviour of road structures under traffic have underlined the importance of observing transient deformations in the structures produced under heavy wheel loads. Research into soil mechanics and road foundations by the National Institute for Road Research was carried out on the shear strength of non-saturated soils under different moisture conditions during the year reviewed, while the stresses set up in the various layers of road foundations by compaction operations or surface loads were closely observed. It is hoped that the combined field and laboratory studies will lead to more rational design of road foundations under South African conditions.

On the economic side, the first phase of the long term study of the costs of road construction and maintenance was continued. Information was collected in a sequence and degree of detail considered to be of most immediate benefit to the road authorities.

An analysis of particular interest was that made of road accidents over a period of eight years, with special reference to the time of day and day of week. The findings that twice as many accidents occurred during the afternoon traffic peak as in the morning traffic peak suggest that the driver fatigue factor plays a considerable part in the incidence of road accidents.



*Die uitwerking van die krag van 'n bewegende voertuig op 'n padoppervlak word gemeet.*

*Measuring the forces exerted on a road surface by a moving vehicle.*

## Bedryfspsigologie

'n Belangrike taak van die Nasionale Instituut vir Personeelnavorsing was die toepassing van indelings- en keuringstoetse op personeel van die Verdedigingsmag. By hierdie toetse speel aanleg om leiding te gee 'n belangrike rol, aangesien dié eienskap veral nodig is vir die uitsoek van offisier-kadette.

Nog 'n kenmerk was die toenemende behoefte aan die invoering van indelingsstoetse vir Naturelle-arbeiders in die nywerheid. Dit het verskeie nuwe terreine gedek. Hierdie toetse is op die deursnee naturelle-arbeidsmag in diens van die Johannesburgse Munisipaliteit gedoen, en het getoon dat hulle voordelig gebruik kan word as 'n middel vir die indeling van hierdie soort arbeiders. Die Instituut word dikwels versoek om behulpsaam te wees by die vasstel van metodes vir die uitsoek van naturelle-arbeiders buite die Unie. Dit was dus nie onverwags dat verder versoeke om hierdie soort hulpverlening uit die Federasie, van die Weskus van Afrika en uit Nigérie ontvang is nie.

Eksperimentele ondersoek met betrekking tot die verband tussen ondervoeding en die verstandelike ontwikkeling van jong kinders wat deur die Departement Psigofisiologie gedoen is, het aan die lig gebring dat 38 persent van 'n groep Bantoe kinders wat aan kwashiorkor gely het, 'n abnormale elektro-ensefalogram gehad het in vergelyking met 3 persent normale kinders. Dit bewys dat 'n ernstige proteïentekort in die vroeë kinderjare 'n skadelike uitwerking op die ontwikkeling van die sentrale sensustelsel kan hê.

'n Studie van voeding met betrekking tot verstandelike ontwikkeling by rotte het 'n paar interessante resultate opgelewer deurdat dit aan die lig gebring het dat rotte geteel van moeders wat aan 'n proteïentekort gely het, en wat self ook op 'n dieet gekenmerk deur 'n tekort aan proteïene gevoer is, minder goed kon leer as die wat normaal geteel en gevoer is.

## Voeding

Wil ons gebreksiektes, verkeerde voeding en ondervoeding bestry, dan is dit absoluut noodsaaklik om goed op hoogte te wees van die mate waarin hierdie toestande onder die verskillende bevolkingsgroepe en in die verskillende distrikte van die Unie voorkom. Gevolglik het die Nasionale Voedingnavorsingsinstituut op 'n klein skaal 'n aanvang gemaak met 'n opname van die voedingstoestand, beginnende met kinders van 5 tot 8 jaar oud in twee naturellestate in Wes-Transvaal en in Atteridgeville, 'n naturelledorp naby Pretoria. Eersgenoemde twee is gekies as voorbeelde uit Naturelle-reservate en laasgenoemde vir vergelykingsdoeleindes as voorbeelde uit die betreklik welgestelde stadsgroepe.

Die Instituut het baie aandag bestee aan die verryking van meliemeel en brood en het in eersgenoemde geval vasgestel dat magou, 'n nie-alkoholiese drank wat baie gewild onder die Bantoe is, 'n goeie medium vir voedingsproewe sou kan vorm, en dat die ongebonde melksuur

## Industrial Psychology

An important task of the National Institute for Personnel Research was the application of classification and selection tests to Defence personnel, in which tests for leadership play a considerable part. This qualification is particularly necessary in the selection of officer cadets.

The increased demand for the introduction of classification tests for Native labour in Industry was a further feature and covered several new fields. These tests applied to a cross section of the Native labour force employed by the Johannesburg Municipality. It was shown that they could be introduced with advantage as a means of classifying this type of labour. The Institute is frequently called upon to assist in establishing selection procedures for Native labour outside the Union; thus it came as no surprise when further requests for help of this nature were received from the Federation, from the West Coast of Africa and from Nigeria.

Experimental studies on the relationship between malnutrition and the mental development of young children conducted by the Psychophysiology Department showed that 38 per cent of a group of Bantu children suffering from kwashiorkor had abnormal electroencephalograms compared with only 3 per cent of normal children. This indicated that severe protein deficiency in early childhood can have damaging effects on the development of the central nervous system.

A study of nutrition in relation to mental development in rats produced some interesting results in that it revealed that rats bred from protein deficient mothers and themselves reared on protein deficient diets were inferior in learning ability to those bred and fed normally.

## Nutrition

If deficiency diseases, wrong feeding and underfeeding are to be fought, it is essential to acquire a thorough knowledge of the incidence of these ills among the various sections of the population and in the various districts of the Union. Consequently, the National Nutrition Research Institute has begun to carry out a nutritional status survey on a small scale, starting with children between the ages of five and eight in two Native villages in the Western Transvaal and at Atteridgeville, a Native township near Pretoria. The two former were chosen as providing examples from Native reserves, and the latter for comparative purposes, as providing examples from the relatively well-to-do urban groups.

The Institute devoted much attention to the enrichment of mealie meal and bread and established, in the first case, that magou, a non-alkoholic drink much favoured by the Bantu, could provide a good vehicle for nutritional experiment, and that the free lactic acid it contains

wat dit bevat, geen nadelige uitwerking op bygevoegde proteïene sou hê, aangesien dit geensins die proteïen-assimilasie van die proefrotte beïnvloed het nie. In die geval van broodverryking is die aandag toegespits op die bepaling van die waarde van vismeelblom as proteïen-byvoeging, en behalwe ander toetse is 'n stikstofbalans-toets vir die eerste maal op menslike wesens gedoen. Navorsing in verband met die verryking van brood met vismeelblom word nog voortgesit en het reeds aan die lig gebring dat die Suid-Afrikaanse produk gunstig afsteek by dergelike produkte uit die buiteland. Die Voedsel- en Voerinspektoraat van die S.A.B.S. is besig om 'n private spesifikasie vir vismeelblom op te stel.

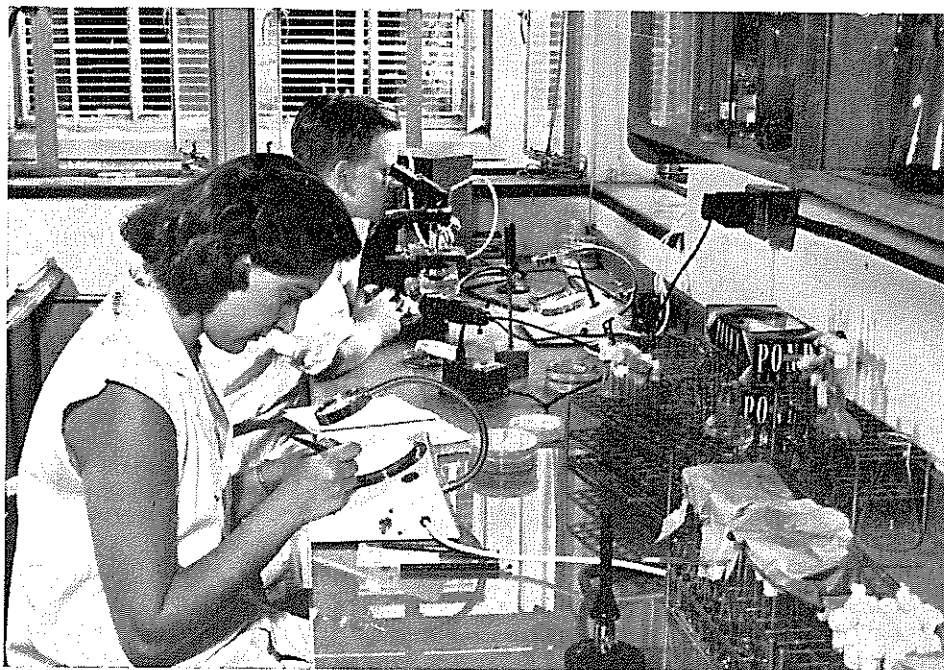
'n Publikasie van heelwat belang vir die voedselhanteringsbedryf was die Gebruikskode vir Voedsel-higiëne deur die Onderafdeling Mikrobiologie van die S.A.B.S. opgestel. As hierdie dokument gebruik sou word, sou dit tot 'n groot verbetering in die metodes van hantering en verduursaming van etensware in Suid-Afrika lei.

'n Bevreëdigende kenmerk van die verslagjaar was dat die kwaliteit van die ingemaakte produkte (met inbegrip van ingevoerde produkte) wat onder die verpligte spesifikasies val wat deur die S.A.B.S. toegepas word, gehandhaaf is. Dit op sigself is 'n duidelik bewys van die sorg wat inmakers oor die hele wêreld daaraan bestee om te verseker dat hul produkte smaaklik is en veilig gebruik kan word.

would have no adverse effect on protein additives, as it has in no way influenced the protein assimilation of the rats used for test purposes. In the second case, attention was centred on the assessment of the value of fish flour as a protein supplement in the enrichment of bread and, among other tests, a nitrogen balance test was for the first time conducted on human beings. Research into the fish flour enrichment of bread is still proceeding and has already revealed that the South African product compares very favourably with similar products from overseas. A private specification for fish flour is under preparation by the Foods and Feeds Inspectorate Division of the S.A.B.S.

A publication of considerable interest to the food handling industry was the Code of Practice for Food Hygiene published by the Microbiological Section of the S.A.B.S., a document which, if implemented, could lead to great improvements in methods of handling and conserving foodstuffs in South Africa.

A gratifying feature of the year under review was that the canned products (including imported products) falling under the compulsory standards administered by the S.A.B.S. maintained a standard of quality which in itself demonstrates the care taken by canners all over the world to ensure safe and palatable foods.



*'n Biologie-laboratorium waarin voedsel bestudeer word.*

*A biological laboratory in which the study of foodstuffs is undertaken.*



### Mediese Navorsing

Tot 'n tiental jare gelede het Suid-Afrika op die gebied van mediese navorsing meer „ontvang” as „gelewer”; dit wil sê ons land moes hom grotendeels op die navorsingsresultate van ander lande verlaat. Vandag is die toestand egter heeltemal anders en word ons skuld op dié gebied vinnig afbetaal. In samewerking met die universiteite en ander wetenskaplike liggame het die W.N.N.R. sestien mediese en tandheelkundige navorsings-eenhede of -groepe opgebou rondom navorsers wat reeds bekendheid op mediese terreine van nasionale belang verwerf het. Binne hierdie eenhede is kondisies geskep wat ideaal vir navorsingswerk is.

Suid-Afrika met sy gemengde bevolking in afsonderlike groepe wat tog naas mekaar leef onder sosiale en ekonomiese omstandighede wat hemelsbreed van mekaar verskil, bied geleenthede aan mediese navorsers wat in geen ander land ter wêreld te vinde is nie.

Een van die onderwerpe waaraan besondere aandag bestee word, is die verband wat daar bestaan tussen dieet en slagaarsiektes; minstens sewe van die Raad se navorsingsinstitute, -eenhede en -groepe hou hulle met die een of ander aspek van hierdie probleem besig.

In die verslag wat verder hierin verskyn, word opsommings van sommige van die resultate van die mediese navorsing in Suid-Afrika gedoen, gegee. Hoe kort hulle ook al aangegee is, sal tog 'n idee daaruit gevorm kan word van die ontsettend uitgebreide terrein wat gedek word en van die potensiele waarde van die werk wat reeds gedoen is.

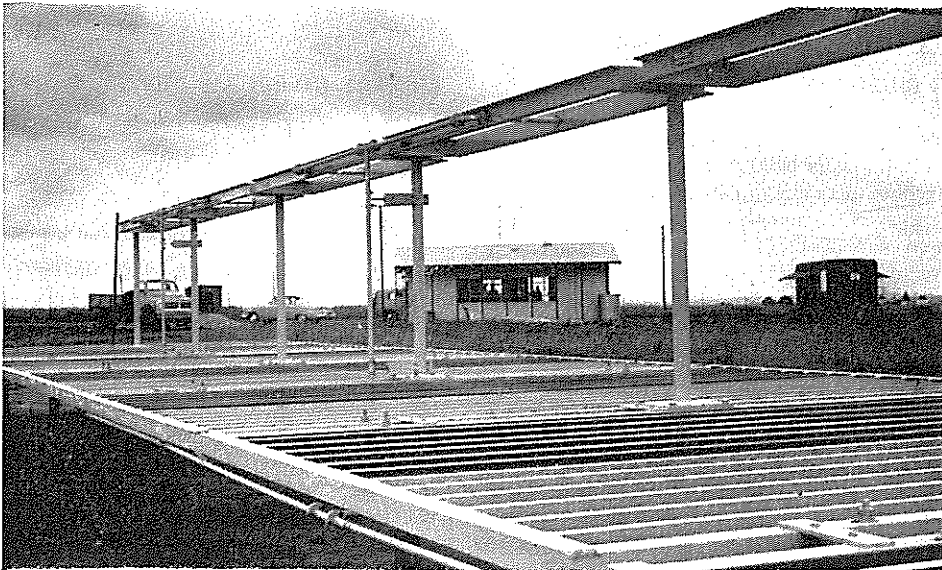
### Medical Research

Up to a decade or so ago, except in a few fields, South Africa could be called a “debtor nation” when it came to medical research, that is to say, this country had to rely largely on the results of research carried out in other countries. The situation to-day has, however, radically altered and the debt is being rapidly repaid. In the Union, in collaboration with the universities and other scientific organizations, the C.S.I.R. has built up sixteen medical and dental research units or groups around research workers who have already achieved eminence in medical fields of national importance. Within these units conditions have been created that are ideal for research.

South Africa, with its mixed population, in groups isolated from each other yet existing side by side under widely differing social and economic conditions, offers opportunities to medical research workers that are available to scientists in practically no other country in the world.

One of the subjects that is receiving particular attention is the relationship between diet and diseases of the arteries, no less than seven of the Council's research institutes, units and groups being concerned with some aspect of this problem. Considerable progress has already been made and South African scientists are undoubtedly among world leaders of research in this sphere.

In the report which follows summaries of some of the results of the medical research carried out in South Africa will be found. Short as they are they may still give some idea of the enormously wide field covered and of the potential value of the work done.



*Die beheerhut by die Minitrack-stasie gesien deur een van die eenhede van die hoof-antennasisteam.*

*A view of the control “shack” at the Minitrack Satellite Station through one of the units of the main antenna system.*

# Departement Inligting en Spesiale Dienste

*Hoof van die Departement: D. G. KINGWILL*

Begin 1958 is die Afdeling Biblioteek en Inligting en die Skakelafdeling gekombineer onder die naam „Departement Inligting en Spesiale Dienste”. Hierdie Departement omvat tans die volgende Afdelings: Biblioteek, Inligting, Reklame en Publikasies, Bedryfsekonomie, Patente.

Op 31 Januarie 1958 het die beampte wat, vandat die Afdeling Biblioteek en Inligting in 1946 in die lewe geroep is, aan die hoof daarvan gestaan het, ons verlaat om 'n betrekking as Senior Lektrise in die Departement Biblioteekwese van die Witwatersrandse Universiteit te aanvaar. Onder die bekwame leiding van hierdie ervare biblioteekaresse het die Raad se Sentrale Biblioteek bekendheid verwerf as die vernaamste wetenskaplike en tegniese naslaanbiblioteek in Suid-Afrika. In hierdie biblioteek is die grondslag gelê vir die opbou van 'n omvattende inligtingsdiens wat tans nog verder uitgebrei word deur aan die bestaande diens vir bibliografiese navrae 'n diens vir tegniese navrae toe te voeg.

Van Junie tot Desember 1957 was die Hoofskakelbeampte aan die Departement van die Federale Eerste Minister en die Kabinetskantoor in Salisbury, Suid-Rhodesië, geleen om die koördinerende en ontwikkeling van wetenskaplike navorsing in die Federasie van Rhodesië en Njassaland te ondersoek en verslag oor sy bevindings aan die Federale Regering uit te bring.

## AFDELING BIBLIOTEEK

### Boekbereiding

Alle organisasies onder beheer van die Raad word op die hoogte gehou van nuwe publikasies op die gebied van die wetenskap en tegnologie deur die rondstuur van advertensies en aankondigings deur die Biblioteek ontvang, wat verantwoordelik is vir die plasing van alle bestellings en vir die reëling van die betaling vir 4,716 boeke, tydskrifte, ens.

Behalwe dat alle aanwinste met die nodige verklarings in die maandblad „C.S.I.R. Information” bekend gemaak word, is 158 spesiale kennisgewings van die ontvangs van publikasies aan lesers gestuur. 3,107 Publikasies is geklassifiseer en 4,774 gekatalogiseer, terwyl die indeks van herdrukke van artikels van lede van die W.N.N.R.-personeel en houers van W.N.N.R.-navorsingsbeurse en -toekennings met 285 kaartjies aangevul is.

Afsonderlike fotokopieë van artikels in wetenskaplike tydskrifte is vir 803 aanvraers verkry; 415 hiervan is in

# Information and Special Services Department

*Head of the Department: D. G. KINGWILL*

At the beginning of 1958, the former Library and Information Division and Liaison Division were combined to form the Information and Special Services Department. This Department now comprises the following Divisions: Library, Information, Publicity and Publications, Industrial Economics, Patents.

On 31st January, 1958, the officer who had been Head of the Library and Information Division since its inception in 1946, left to become Senior Lecturer in the Department of Librarianship at the University of the Witwatersrand. Under her experienced and able guidance, the Council's Central Library has become recognized as the main scientific and technical reference library in South Africa. In this library, the foundations were laid for the development of a comprehensive information service which is now being extended by the addition of technical inquiry services to the bibliographic inquiry services which have already been established.

From June to December, 1957, the Chief Liaison Officer was seconded to the Department of the Federal Prime Minister and Cabinet Office in Salisbury, Southern Rhodesia, to investigate and report to the Federal Government on the co-ordination and development of scientific research in the Federation of Rhodesia and Nyasaland.

## LIBRARY DIVISION

### Processing

All organizations falling under the Council are kept informed of new publications in science and technology by circulating advertisements and announcements received by the Library, which was responsible for placing all orders and arranging payment for 4,716 items.

In addition to annotated announcements of accessions in the monthly bulletin “C.S.I.R. Information”, 158 special announcements of the receipt of publications were sent to readers. 3107 publications were classified, 4,774 catalogued and 285 record cards were added to the index of reprints of articles by members of the C.S.I.R. staff and holders of C.S.I.R. research bursaries and grants.

Single photographic copies of articles in scientific journals were obtained for 803 inquirers. Of these, 415



Suid-Afrika verkry (deur W.N.N.R. afgedruk), 166 deur die Wetenskaplike Skakelkantoor in Washington en 222 deur die Wetenskaplike Skakelkantoor in Londen.

#### **Uitleenonderafdeling**

Altesaam 42,457 publikasies is uitgeleen, waarvan 847 aan persone buite die W.N.N.R.

Die aan ander biblioteke gestuurde lyste van duplikaatemplare van die biblioteek se 2,000 tydskrifte, het daartoe gelei dat 2,405 van die duplikate aan 64 inrigtings verskaf is; 428 tydskrifjaargange is na 'n plaaslike firma gestuur om gebind te word en die bestaande versameling gebonde jaargange is met 880 aangevul.

#### **Katalogus van Tydskrifte in die Unie**

Redigeerwerk i.v.m. die instandhouding en hersiening van die katalogus van tydskrifte in die Unie ('n lys tydskrifte wat in Suid-Afrikaanse Biblioteke aangehou word) is voortgesit. Die kaarte wat eers volgens die onderwerptrefwoord gerangskik was, is nou alfabeties (volgens titel) gerangskik.

### **INLIGTINGSAFDELING**

#### **Navrae**

Vier honderd sewe-en-sewentig bibliografiese navrae is behandel; dit het bibliografiese naslaanwerk vereis wat baie tyd in beslag geneem het. Gedurende Februarie en Maart is 110 tegniese navrae ontvang, waarvan omtrent n kwart baie belangrik was.

Onder die meer belangrike onderwerpe van navrae was daar die volgende: vlugtige olies, die ontwatering van piesangs, haai-afweermiddels, die giftigheid van mangaanverbindinge, die anodisering van aluminium, brandbeveiliging, puls-stuuraalmotors, die ontwerp van tropiese laboratoriums, vibrasietoetsing, bagasse vir papiermaak, gebruiksmoontlikhede van litium, papaien, die gebruik van setielalkohol om verdamping van watervlakke te verminder, Quelea-voëls, rekenoutomate, atoomkragstasies.

#### **Vertalings**

Die vertalers het 2,861 bladsye vertaalwerk gedoen uit Engels, Afrikaans, Duits, Frans, Italiaans, Sweeds en Nederlands.

Hierdie Onderafdeling het die verantwoordelikheid vir die byhouding van die Statebondsindeks van Vertalings oorgeneem; dit is 'n kaartindeks van wetenskaplike artikels waarvan vertalings in verskillende institute in die Britse Statebond gemaak is. Deur middel van hierdie skema wat deur die „British Commonwealth Scientific Office" in Londen begin is, is dit moontlik om afskrifte van vertalings wat in die indeks voorkom, te verkry waardeur dubbele moeite vermy word. Hierdie indeks is

were obtained in South Africa (copied by C.S.I.R.), 166 through the Scientific Liaison Office in Washington and 222 through the Scientific Liaison Office in London.

#### **Lending**

In all, 42,457 publications were issued on loan, of which 847 were to individuals outside the C.S.I.R.

Lists of duplicate numbers of the library's 2,000 journals sent to other libraries resulted in 2,045 items being disposed of to 64 institutions; 428 volumes of journals were sent to a local firm of binders and 880 volumes added to the collection of bound volumes.

#### **Catalogue of Union Periodicals**

Editorial work in connection with the maintenance and revision of the catalogue of Union Periodicals (a list of South African library holdings of periodicals) has continued. All cards have been transferred from the subject-catchword arrangement to the alphabetical (by title) arrangement.

### **INFORMATION DIVISION**

#### **Enquiries**

In all 477 bibliographical enquiries were dealt with, many of them entailing long bibliographical searches. During February and March 110 technical enquiries were received, about one-quarter of which were major enquiries.

Some of the more important subjects of enquiry included: essential oils, dehydration of bananas, shark repellents, toxicity of manganese compounds, anodising of aluminium, fire protection, pulsed ram jets, design of tropical laboratories, vibration testing, bagasse for paper making, lithium uses, papain, the use of cetyl alcohol for reducing evaporation from water surfaces, Quelea birds, computers, atomic power stations.

#### **Translations**

The translators completed 2861 pages of translations including translations from English, Afrikaans, German, French, Italian, Swedish and Dutch.

This Section took over the responsibility for maintaining the Commonwealth Index of Translations, which is a card index of scientific articles of which translations have been made in institutions in the Commonwealth. Through this scheme, which was initiated through the British Commonwealth Scientific Office in London, it is possible to obtain copies of translations included in the index and thus to obviate duplication of effort. This index

baie nuttig en vorm 'n uitstekende voorbeeld van samewerking gebaseer op die gemeenskaplik taal van die Britse Statebond.

#### **Inligtingspublikasies**

Die 1956-deel van die *Register van Huidige Wetenskaplike Navorsing aan Suid-Afrikaanse Universiteite*, waarin 534 navorsingsprojekte aangegee word, is voltooi en versprei. Die basiese werk i.v.m. die samestelling van die 1957-deel is voltooi. Die uitbring van hierdie publikasie is deur die Afdeling Publikasies oorgeneem.

Die gemiddelde aantal inskrywings in die maandelikse geannoteerde aanwinstelys, *C.S.I.R. Information*, het van 150 tot 200 gestyg. Lesers kan nou eksemplare van die biblioteek se kataloguskaarte van alle inskrywings in die aanwinstelys kry vir hul persoonlike gebruik, as hulle binne 14 dae na verskyning van die lys aansoek daarom doen.

#### **Die Internasionale Geofisiese Jaar (IGJ)**

Suid-Afrika is een van die 63 nasies wat deelneem aan die werk i.v.m. die Internasionale Geofisiese Jaar, waarmee in Julie 1957 'n begin gemaak is, en die W.N.N.R. was verantwoordelik vir die samestelling van die Suid-Afrikaanse Nasionale Komitee vir die IGJ en vir die voorsiening van sekretariële dienste deur hierdie Afdeling.

Die Suid-Afrikaanse program sluit deelname in aan die volgende dissiplines: Wêrelddae, Meteorologie, Geomagnetisme, Aurora, Ionosfeer, Sonaktiwiteit, Kosmiese Strale, Lengte- en Breedtegrade, Oseanografie, Satelliet-waarnemings, Seismologie, Swaartekrag en Kernstraling.

Ongeveer tagtig IGJ-poste is in Suid-Afrika, Marion-eiland, Tristan da Cunha en Gough-eiland opgerig. Die welslae van die onderneming is grotendeels te danke aan die hulp wat van die staatsdepartemente, universiteite, die Suid-Afrikaanse Spoorwegadministrasie, sterrewagte, private organisasies en W.N.N.R.-laboratoriums ontvang is.

Ten einde van 1957 het die meeste poste gegewens na die Wêrelddatasentra in die Verenigde State en Rusland, asook na die ondergeskikte datasentra in verskillende ander lande, deurgestuur.

Die volgende publikasies is uitgebring en versprei: *South African Programme for the IGY 1957-1958*; *A Guide to Visual Observation of the Aurora* en *A Report on the IGY in Africa South of the Sahara*.

Onder die treffendste gebeurtenisse verdien die volgende vermelding:

Die Aurora Australis (Suidelig) is in September 1957 sover in die Noorde gesien as Colesberg.

Die Optiese Waarnemingstasie op Olifantsfontein en die „Prime Minitrack“-stasie (radiowaarneming) op Esselen Park is opgerig en toegerus met Amerikaanse instrumente ter waarde van ongeveer (£140,000 wat deur die Smithsonian Institution en die Amerikaanse Vloot

is proving very useful and affords an outstanding example of co-operation based on the common language of the British Commonwealth.

#### **Information Publications**

The 1956 volume of the *Register of Current Scientific Research at South African Universities*, which included 534 research projects, was completed and distributed. The basic work on the compilation of the 1957 edition was completed. Production of this publication has been taken over by the Publications Division.

The average number of entries in the monthly annotated library accessions list, *C.S.I.R. Information* was increased from 150 to 200.

For the personal reading lists, readers can now obtain copies of the library catalogue cards of all entries in the accessions list, if they make application within 14 days of issue.

#### **International Geophysical Year (IGY)**

South Africa is one of the sixty-three nations participating in the International Geophysical Year which began in July, 1957, and the C.S.I.R. has been responsible for the formation of the South African National Committee for the IGY and for the provision of secretarial services by this Division.

The South African programme includes participation in the disciplines of World Days, Meteorology, Geomagnetism, Aurora, Ionosphere, Solar Activity, Cosmic Rays, Longitudes and Latitudes, Oceanography, Satellite Observations, Seismology, Gravity and Nuclear Radiation.

Approximately eighty IGY stations have been set up in South Africa, Marion Island, Tristan da Cunha and Gough Island. The success of the undertaking has been largely due to the assistance received from government departments, universities, the South African Railways Administration, observatories, private organizations and C.S.I.R. laboratories.

By the end of 1957 the majority of the stations were transmitting data to the main World Data Centres in the United States and Russia and to the subsidiary data centres in various other countries.

The following publications were produced and distributed: *South African Programme for the IGY 1957-58*; *A Guide to Visual Observation of the Aurora* and *A Report on the IGY in Africa South of the Sahara*.

Of the most spectacular events the following merit mention: The Aurora Australis (Southern Lights) were seen as far North as Colesberg in September, 1957.

The Optical Tracking station at Olifantsfontein and the Prime Minitrack station (radio tracking) at Esselen Park were set up with the aid of American equipment valued at approximately £140,000 supplied by the Smithsonian Institution and the United States Navy. The optical tracking station was the first in the world to photograph



verskaf is. Die optiese waarnemingstasie was die eerste ter wêreld wat die Amerikaanse satelliet 1958 Alfa gefotografeer het, en 'n noemenswaardige prestasie van die Minitrack-stasie was dat hulle radioseine van die Amerikaanse satelliet 1958 Gamma opgevang het voordat hy sy eerste baan klaar afgelê het. In Maart is twee geslaagde weervlugte deur Shackleton-vliegtuie van die S.A.L.M. na Marioneiland gemaak. 'n Suid-Afrikaner was lid van Fuchs se Suidpool-ekspedisie. 'n Skip van die Suid-Afrikaanse vloot het saam met die navorsingskip „Vema” van die „Lamont Geological Observatory” met sukses seismiese metings ter see gedoen.

#### **Internasionale Wetenskaplike Verenigings**

Die W.N.N.R. verteenwoordig die Suid-Afrikaanse regering in die Internasionale Raad van Wetenskaplike Verenigings en is ook lid van die volgende Verenigings:

- Die Internasionale Astronomiese Vereniging
- Die Internasionale Vereniging vir Biologiese Wetenskappe
- Die Internasionale Vereniging vir Suiwere en Toegepaste Chemie
- Die Internasionale Kristallografievereniging
- Die Internasionale Geodesie- en Geofisikavereniging
- Die Internasionale Vereniging vir Suiwer en Toegepaste Fisika
- Die Internasionale Wetenskaplike Radiovereniging.

Ter nakoming van die regulasies van die Internasionale Vereniging vir Suiwer en Toegepaste Fisika en die Internasionale Kristallografievereniging, is nasionale komitees in die lewe geroep. In eersgenoemde geval is die nasionale komitee in samewerking met die Suid-Afrikaanse Fisika-Instituut gevorm.

#### **DIE LONDENSE KANTOOR**

##### **Besoekende Wetenskaplikes**

Die aantal besoekende wetenskaplikes wat van die geriewe deur hierdie kantoor gebied, gebruik gemaak het, het van 47 verlede jaar tot 75 gestyg en die kantoor het nouliks genoeg hulpbronne gehad om aan al die versoekte te voldoen.

Van die 75 besoekers gedurende die verslagjaar het 51 van die W.N.N.R. gekom en o.a. die President, die Vice-President en twee Direkteurs van Laboratoriums ingesluit. Spesiale hulp is verleen aan missies in verband met die opstel van 'n Suid-Afrikaanse navorsingsprogram vir atoomenergie, lugverdediging, en die aankoop van 'n elektroniese rekenoutomaat. Die besoek van mnr. T. L. Wadley om die „Tellurometer” te demonstreer het toevallig saamgeval met die bereiking van volskaalse produksie van die T.R.L. (Wadley)-ontvangtoestel met kristal-beheer deur Racal Engineering Ltd., wat die

the United States satellite 1958 Alpha, and the Minitrack station accomplished the feat of obtaining radio signals from the United States satellite 1958 Gamma before it had completed its first orbit. During March two successful weather flights were made to Marion Island by Shackleton aircraft of the S.A.A.F. A South African was a member of the Fuchs Trans-Antarctic Expedition. A South African Naval vessel carried out a successful project of seismic measurements at sea in conjunction with the Lamont Geological Observatory's research vessel, 'Vema'.

#### **International Scientific Unions**

The C.S.I.R. adheres to the International Council of Scientific Unions on behalf of the South African Government and is a member of the following Unions:

- International Astronomical Union
- International Union of Biological Sciences
- International Union of Pure and Applied Chemistry
- International Union of Crystallography
- International Union of Geodesy and Geophysics
- International Union of Pure and Applied Physics
- International Scientific Radio Union

To conform with the regulations of the International Union of Pure and Applied Physics and the International Union of Crystallography, national committees were set up. In the case of the former the national committee was formed with the cooperation of the South African Institute of Physics.

#### **LONDON OFFICE**

##### **Visiting Scientists**

The number of visiting scientists using the facilities of this office, increased from 47 last year to 75 and its resources have scarcely been able to keep up with the demands made on it.

Of the 75 visitors during the period, 51 came from the C.S.I.R. and included the President, Vice-President and two Directors of Laboratories. Special assistance was given to missions concerned with the formulation of a South African atomic energy research programme, air defence, and the purchase of an electronic computer. The visit of Mr. T. L. Wadley to demonstrate the “Tellurometer” happened to coincide with the coming into full-scale production of the T.R.L. (Wadley) Crystal-Controlled Receiver by Racal Engineering Ltd., the

Raad se lisensiehouders is. Die Skakelkantoor het in belangrike mate deelgeneem aan die werksaamhede in verband met hierdie gebeurtenisse.

#### **Navrae**

Twee-en-sestig wetenskaplike navrae in verband met 'n groot verskeidenheid onderwerpe is behartig.

#### **Dokumentasie**

Na aanleiding van spesifieke versoeke is afskrifte van 326 artikels uit seldsame wetenskaplike tydskrifte en ander publikasies na die Unie gestuur, buiten en behalwe 'n aantal van die jongste verslae wat deur die kantoor ontvang of spesiaal verkry is. Die koerantuitknipseldiens van die „Times” en die „Financial Times” is gehandhaaf.

#### **Komitees en Konferensies**

Behalwe dat die Wetenskaplike Skakelbeampte die Unie op 'n aantal wetenskaplike statebondskomitees en in die beherende liggaam van die *Imperial College of Science and Technology* verteenwoordig, het hy ook nog steeds in die Reëlingskomitee van die Toegepast-Natuurwetenschappelijk Onderzoek se Internasionale Ontsoeringsprojek gedien waarby 'n groot aantal ingewikkelde patentprobleme opgelos moes word.

#### **Besoeke**

Besoeke is afgelê by tahyke atoomenergie navorsings-ondernemings (onder beheer van sowel die Verenigde Koninkryk se Atoomenergie-oowerheid as van die private nywerheid) en by die National Physical Laboratory, Teddington, Edwards High Vacuum Ltd., die Laboratoriums van die Wellcome Foundation Ltd., die Cereals Research Station, die Leather Research Association, die Fire Research Station, Racal Engineering Ltd., die Permutit Co., Ltd., en die firma William Body. Bowendien is, danksy die gasvryheid van Toegepast-Natuurwetenschappelijk Onderzoek, 'n baie leersame besoek van 4 dae aan die navorsingsentrums en grondherwinningsgebiede in Nederland gebring.

#### **Aanwerving van Personeel**

Dertien reekse advertensies is geplaas vir vakante betrekings in Laboratoriums van die W.N.N.R. en die Navorsingsverenigings. Navrae is van ongeveer 108 potensiële applikante wat op die advertensies geantwoord het, ontvang en beantwoord. Bowendien is besonderhede omtrent werkgeleentheid in Suid-Afrika aan 40 afsonderlike navraers verstrekk en alle moontlike moeite is gedoen om hulle met moontlike werkgewers in aanraking te bring. Die Wetenskaplike Skakelbeampte het 14 applikante in onderhoude ondervra en reëlings vir 11 instrumentmakers getref vir onderhoude met die Hoof van die W.N.N.R. se Sentrale Werkplaas. Die vervoer van sewe persone wat aanstellings by die W.N.N.R. gekry het, en hul gesinne na die Unie is ook gereël.

Council's licensees. The Liaison Office played a considerable role in the activities associated with these events.

#### **Enquiries**

Sixty two scientific enquiries, covering a large variety of subjects, were dealt with.

#### **Documentation**

In response to specific requests, copies of 326 papers from rare scientific journals and other publications were sent to the Union, in addition to a number of current reports which had been received or specially procured by the office. The press cutting service from the “Times” and the “Financial Times” was maintained.

#### **Committees and Conferences**

In addition to representing the Union on a number of Commonwealth scientific committees and the Governing Body of the Imperial College of Science and Technology, the Scientific Liaison Officer continued to serve on the Steering Committee of the Toegepast-Natuurwetenschappelijk Onderzoek International Demineralisation Project, where many complex patent problems had to be resolved.

#### **Visits**

Visits were paid to many atomic energy research establishments (under the control of both the United Kingdom Atomic Energy Authority and private industry), and to the National Physical Laboratory, Teddington, Edwards High Vacuum Ltd., the Laboratories of the Wellcome Foundation Ltd., the Cereals Research Station, Leather Research Association, Fire Research Station, Racal Engineering Ltd., the Permutit Co. Ltd., and Messrs. William Body. In addition, thanks to the hospitality of Toegepast-Natuurwetenschappelijk Onderzoek, a most instructive 4-day visit was paid to research centres and reclamation areas in the Netherlands.

#### **Recruitment of Staff**

Thirteen series of advertisements were placed for vacant posts in Laboratories of the C.S.I.R. and the Research Associations. Enquiries from some 108 potential applicants were received and dealt with in response to these advertisements. In addition, details of opportunities in South Africa were given to 40 independent enquirers and every effort was made to put them in touch with possible employers. Fourteen applicants were interviewed by the Scientific Liaison Officer and arrangements made for 11 instrument makers to be interviewed by the Head of the C.S.I.R. Central Workshops. The transport of seven new appointees and their families to the Union was also arranged.



## DIE WASHINGTONSE KANTOOR

Die Hoof van die Kantoer het vir die maande Augustus en September 1957 na Suid-Afrika teruggekeer en die meeste van sy tyd diens in Pretoria en elders gedoen waar hy persoonlike kontakte hernu en hom op die hoogte gestel het van die huidige wetenskaplike en tegniese toestand in Suid-Afrika oor die algemeen, en in die W.N.N.R. en die Navorsingsinstitute in die besonder. Hy het oor Oostenryk na Amerika teruggegaan en 'n maand in Wenen deurgebring as lid van die Suid-Afrikaanse afvaardiging na die vergaderings waarop die Internasionale Atoomenergie-agentskap gestig is. Daarna het hy onderskeidelik 'n paar dae in die Skakelkantoer in Keulen en dié in Londen deurgebring voor hy einde November 1957 in Washington teruggekeer het.

Die aard en algemene peil van die werksaamhede van die Kantoer het min of meer dieselfde gebly as die afgelope paar jaar. Oor die algemeen kan hierdie werksaamhede in drie hoofkategorieë onderverdeel word: (1) die verkryging van dokumente, (2) die inwinning van inligting, en (3) die tref van reëlins vir besoekende wetenskaplikes. Wat hierdie werksaamhede betref dien die Kantoer nie alleen die W.N.N.R. en die verskillende nywerheidsnavorsingsinstitute nie, maar ook verskillende staatsdepartemente en agentskappe, die universiteite, professionele en private wetenskaplike en tegniese organisasies, ens.

Die werksaamhede van die Kantoer dek sowel Kanada as die Verenigde State, en op versoek verstrek hulle inligting omtrent Suid-Afrika aan organisasies en burgers van daardie lande en help hulle waar hulle kan.

Die afgelope jaar is gekenmerk deurdat die waarde van die wetenskap in die menslike lewe en die politieke implikasies van wetenskaplike en tegniese ontwikkeling wat nasionale beleid en internasionale betrekkings betref, plotseling erken en benadruk is. Dit het nie sonder reperkusies op die werk van die Kantoer geskied nie en blyk duidelik uit die steeds groter mate waarin die Hoof van die Kantoer saam met die Ambassadeur en sy personeel in sake van hierdie aard betrek word.

## DIE KEULENSE KANTOOR

Die werk van die S.A. Wetenskaplike Skakelkantoer het geleidelik toegeneem sedert sy oprigting in September 1956.

Die samewerking tussen die Wetenskaplike Skakelkantoer en die verskillende afdelings van die Ambassade bly nog steeds baie goed en die kantoer word as die wetenskaplike afdeling van die Ambassade beskou.

Ooreenkomstig die algemene beleid deur die Ambassadeur aanvaar, is die kantoer by verskeie geleenthede versoek om navrae van wetenskaplike aard deur die Ambassade van die Departement van Buitelandse Sake,

## WASHINGTON OFFICE

The Head of the Office returned to South Africa for the months of August and September, 1957, most of the time being spent on duty in Pretoria and elsewhere, in renewing personal contacts and in becoming familiar with the present scientific and technical scene in South Africa generally, and in the C.S.I.R. and the Research Institutes in particular. He returned via Austria where he spent a month in Vienna as a member of the South African delegation to the meetings which established the International Atomic Energy Agency. Thereafter he spent a few days with each of the Liaison Offices in Cologne and London, before returning to Washington late in November, 1957.

The nature and general level of the activities of the Office have remained very much as in recent years. In general these activities can be divided into three main categories: (1) document procurement, (2) information gathering, and (3) arrangements for visiting scientists. In respect of these activities the Office serves not only the C.S.I.R. and the various industrial research institutes, but various government departments and agencies, the universities, professional and private scientific and technical organisations, and so on.

The activities of the Office cover both Canada and the United States and, when requested, the furnishing of information and assistance in respect of South Africa to organizations and citizens of these countries.

A feature of the past year has been the sudden recognition and emphasis on the value of science in human affairs, and the political implications of scientific and technical developments in respect of national policies and international relations. This has not been without its repercussions on the work of this Office, and is apparent from the ever-increasing degree to which the Head of the Office is being drawn into matters of this kind with the Ambassador and his staff.

## COLOGNE OFFICE

The work of the S.A. Scientific Liaison Office has gradually increased since its establishment in September, 1956.

The cooperation between the Scientific Liaison Office and the various sections of the Embassy continues to be very good and the office is regarded as the scientific section of the Embassy.

In accordance with the general policy adopted by the Ambassador, the office was on various occasions asked to deal with queries of a scientific nature received by the

Duitse ondernemings of van ander kante ontvang, te behartig.

#### **Besoekende Wetenskaplikes**

Reëlings vir besoekende W.N.N.R.-personeel vorm een van die vernaamste werksaamhede van die kantoor. 'n Taamlke hoeveelheid algemene inligting omtrent navorsingsinrigtings in Duitsland en Holland is tans beskikbaar, dog die kontak met België, Switserland en Oostenryk is nog maar bra skraal. Dit geld ook vir Italië, waar die Keulense kantoor ook so nou en dan onderhoude moet reël.

Gedurende die jaar het in die geheel 43 wetenskaplikes van Suid-Afrika af die Skakelkantoor besoek om sake waarin hulle belang stel te bespreek of om hulp in ander opsigte gevra i.v.m. reise of onderhoude. Onder hulle was daar nege van organisasies wat nie regstreeks met die W.N.N.R. in verband gestaan het nie, soos Landbou, Gesondheid, Universiteite en die Nywerheid. In 27 gevalle moes die kantoor 'n deel van sy tyd bestee om reëlings te tref i.v.m. onderhoude, reise en/of huisvesting.

#### **Aanwerving van Personeel**

Altesame het 273 mense belang gestel in werk in Suid-Afrika en tussen 30 en 40 van hulle is tydens onderhoude ondervra. Verkseie kandidate vir poste in die Landbou, Geologiese Opname, die Universiteite en die Nywerheid het ook die kantoor geraadpleeg. 'n Taamlke aantal het die kantoor in hul private hoedanigheid genader.

Hier moet daarop gewys word dat die Duitse nywerheid vandag 'n bloeydperk beleef en taamlk hoë salarisse betaal. Staats- en navorsingsorganisasies was daardeur ook verplig om hulle salarisse te verbeter. Die toestand het die afgelope paar jaar dus heelwat verander en mans met 'n redelike mate van ervaring eis tans baie hoër betaling as wat die W.N.N.R. aanbied. Heeltemal jong mans doen aansoek om betrekkings as senior of eerste navorsingsbeamptes, dog laboratorium-assistente en tegnisi is nog gewillig om hierheen te kom. Die posisie in Holland is amper net so. Poste word in Duitsland en Holland geadverteer deur bemiddeling van die voorgeskrewe Goewermentsowerhede.

#### **Wetenskaplike Navrae**

Die kantoor het 'n toenemende aantal versoeke om inligting i.v.m. wetenskaplike aangeleenthede behandel wat nie alleen van institute van die W.N.N.R. af gekom het nie maar ook van ander Suid-Afrikaanse en verskillende Duitse navraers. Die totale aantal was omtrent 30 en dit het 'n uitgebreide reeks onderwerpe gedek, soos salarisskale vir wetenskaplikes, serebrale verlamming, die verwydering van boomstompe, lugbesoedeling, juut-surrogaatvesels, verryking van brood, die gebruik van afvalprodukte en haai-afweermiddels.

Embassy from the Department of External Affairs, German Institutions or other quarters.

#### **Visiting Scientists**

Arrangements for visiting C.S.I.R. staff constitute one of the major activities of the office. A fair amount of general information about the research institutions, in Germany and Holland is now available, but contacts with Belgium, Switserland and Austria are still rather meagre. This also applies to Italy, where the Cologne office is also on occasion called upon to arrange interviews.

During the year a total of 43 scientists from South Africa either visited the Liaison Office for discussions of matters in which they were interested or asked for assistance in other ways in connection with their travelling or interviews. Of these nine were from organizations not directly connected with the C.S.I.R., such as Agriculture, Health, Universities and Industry. In 27 cases the office had to devote a certain amount of time to making arrangements in connection with interviews, travelling and /or accommodation.

#### **Recruitment**

In all 273 people were interested in work in South Africa and between 30 and 40 of these were interviewed. Several candidates for posts in the Department of Agriculture, Geological Survey, Universities or Industry also consulted the office. Quite a few approached the office in their private capacity.

It must be noted here that German industry today is flourishing and pays fairly high salaries. State and research organizations therefore have also had to improve their salaries. The position has thus altered considerably in the past few years and reasonably experienced men now demand salaries much in excess of those offered by the C.S.I.R. Quite junior men apply for senior or principal research grades, but laboratory assistants and technicians are still attracted. The position in Holland is somewhat similar. Advertising of posts in Germany and Holland is done through the prescribed Government authorities.

#### **Scientific Queries**

The office dealt with an increasing number of requests for information on scientific matters, coming not only from institutions of the C.S.I.R. but also from other South African and various German enquirers. The total number was about 30 and the subject matter covered a large range of subjects, such as salary scales for scientists, cerebral palsy, removal of tree stumps, air pollution, jute substitute fibres, fortification of bread, utilization of waste products and shark repellents.



## Versoeke om leesstof

Altesame is sowat 60 versoeke om herdrukke of fotokopieë van artikels of om ander inligting omtrent publikasies behandel. Ongeveer die helte daarvan was van die W.N.N.R.-biblioteek afkomstig, maar daar was ook 'n paar van ander W.N.N.R.-institute en Suid-Afrikaanse organisasies terwyl daar ook heelwat van Duitse bronne afkomstig was.

## Institute en Konferensies wat besoek is

Met die hulp van die S.A. Ambassade in Den Haag is besoek van 8 dae aan 'n aantal Nederlandse Navorsings-institute gedurende die jaar gereël. Dit is ook deur die Ambassadeur in Holland verwelkom wat gemeen het dat vanweë die feit dat wetenskaplike liggame in Nederland dikwels versoeke om hulp ontvang, nouere regstreekse kontak behoort gemaak te word. Gevolglik is besoek afgelê by 'n paar staatsamptenare en by die Toegepast-Natuurwetenskapelijk Onderzoek se hoofkantoor in Den Haag, by verskeie institute van die T.N.O. en die Technische Hogeschool in Delft, die T.N.O.-institute in Utrecht, die departement van die Landbou-universiteit in Wageningen, die Departement Chemie van die Amsterdamse Universiteit en die Shell-navorsingslaboratorium in Amsterdam, en by die navorsingslaboratoriums van Philips op Eindhoven.

By 'n ander geleentheid toe dit nodig geword het om aplikante te ondervra en werwingsake in Frankfurt a.d. Main te bespreek, is drie ekstra dae bestee aan besoeke aan Geisenheim (Departement Chemie van die Landboukollege), Frankfurt (Dechema) Mannheim (ingenieurswerke van Mohr & Federhoff), Karlsruhe (Tegniese Universiteit en Forchheim-Tabaknavorsingstasie), en Stuttgart (Tegniese Universiteit en die Max-Planck-Institut für Metallforschung).

Die 19de konferensie van die nasionale lede van die Internasionale Vereniging vir Suiwere en Toegepaste Chemie en die 16de Internasionale Kongres wat albei gelyk van 16 tot 25 Julie 1957 in Parys gehou is, is vir drie dae bygewoon en 'n aantal kontakte is daar gemaak. Navorsingswerkers in chemie wat voornemens is om in 1959 'n studiereis in die buiteland te maak, sou wyslik handel as hulle hul reisplan so inrig dat hulle aan die 17de Internasionale Kongres wat van 30 Aug. tot 6 Sept. in München gehou word, kan deelneem.

## AFDELING PUBLIKASIES EN REKLAME

Buiten en behalwe die werk i.v.m. die Raad se gereelde publikasies, die *Jaarverslag*, *Navorsingsoorsig* ('n kwartaalblad), *S.A. Standaardbulletin* ('n maandblad) en *Keur van Wetenskaplike Nuus* ('n weekblad) is daar ook gedurende die jaar aan 'n aantal algemene publikasies gewerk, o.a. 'n boek getitel *Navorsing in Diens van die Staat en die Nywerheid* waarin opsommings gegee word van die

## Requests for Literature

In all some 60 requests for reprints or photo-copies of articles, or for other information about publications were dealt with. About half of these were from the C.S.I.R. library, but some came directly from other C.S.I.R. institutions or South African organizations, whilst quite a number were from German sources.

## Institutions and Conferences visited

With the assistance of the S.A. Embassy at The Hague a visit of eight days to a number of Dutch research institutions was planned during the year. This was also welcomed by the Ambassador in Holland who felt that in view of the frequent requests for assistance submitted to scientific bodies in Holland, closer direct contact should be made. Consequently, visits were paid to a few Government officials and to the Toegepast-Natuurwetenskapelijk Onderzoek Head Office at The Hague, to several institutions of Toegepast-Natuurwetenskapelijk Onderzoek and of the Technical University at Delft, to Toegepast-Natuurwetenskapelijk Onderzoek institutes at Utrecht, to departments of the Agricultural University at Wageningen, the Chemistry Department of the University and the research laboratory of Shell at Amsterdam, and to the Philips research laboratories at Eindhoven.

On another occasion, when it became necessary to interview applicants and discuss recruitment matters in Frankfurt/Main, three additional days were devoted to visits in Geisenheim (Chemistry Department of Agricultural College), Frankfurt (Dechema), Mannheim (engineering plant of Mohr & Federhoff), Karlsruhe (Technical University and Forchheim Tobacco Research Station), and Stuttgart (Technical University and Max-Planck-Institut für Metallforschung).

The 19th conference of the national members of the International Union for Pure and Applied Chemistry and the simultaneous 16th International Congress held in Paris from 16th to 25th July, 1957, was attended for three days and a number of contacts made. Research workers in chemistry contemplating overseas study tours in 1959 would do well to arrange their itineraries in such a way as to enable them to take part in the 17th International Congress to be held in München from 30th August to 6th September.

## PUBLICATIONS AND PUBLICITY DIVISION

In addition to the Council's regular publications, *Annual Report*, *Research Review* (quarterly), *S.A. Standards Bulletin* (monthly), and *Science News Selections* (weekly) work was done during the year on a number of general publications, among them a book entitled *Research in the Service of Government and Industry* giving summaries of the scientific research undertaken in the

wetenskaplike navorsing wat in die Raad se laboratoriums gedoen word. 'n Bybehorende deel wat 'n lys van al die wetenskaplike verhandelings en publikasies bevat wat oor die afgelope twaalf jaar hul oorsprong in die laboratoriums gehad het, wag tans op verspreiding. Nog 'n pamflet in die reeks waarin die werksaamhede van die nasionale navorsingslaboratoriums beskryf word, is in voorbereiding en handel oor die Nasionale Voedingnavorsingsinstituut.

Gedurende die jaar het die afdeling van 3 tot 4 navrae per week omtrent loopbane in wetenskaplike navorsing en werkgeleentheid in die W.N.N.R. afgehandel. Om in hierdie klaarblyklike behoefte te voorsien is 'n klein pamfletjie opgestel en aan skole en ander belanghebbende organisasies uitgedeel. 'n Meer omvattende pamflet is in voorbereiding. Op versoek van die Huishoudkundeafdeling van die Landboudepartement is 'n herdruk in ingebonde vorm gemaak van vyf artikels wat in onlangse nommers van die *Standaardbulletin* verskyn het en van besondere belang vir vroue was. Die Buro vir Standaarde se *Verbruikersgids* is bygewerk en weer in 'n verskillende vorm uitgegee.

Afgesien van die meer formele publikasies het die afdeling ongeveer 59 persberigte vrygestel en 'n aantal artikels opgestel oor die verskillende aspekte van navorsing en standaardisering vir die tegniese en wetenskaplike tydskrifte. Heelwat hulp is verleen aan die redakteur van *Lantern* by die produksie van 'n proefuitgawe van *Archimedes*, 'n voorgestelde nuwe wetenskaplike tydskrif vir skoolgebruik.

Die afdeling het ook 'n reeks „besoekdae” vir sowel die S.A. Buro vir Standaarde as die navorsingslaboratoriums op die nuwe terrein georganiseer. Reëlings is getref vir besoeke deur 'n aantal groepe en individuele wetenskaplikes, met inbegrip van verskeie uit die buitenland, aan die laboratoriums.

Met die verhuising van die Skakelafdeling na die nuwe administrasiegebou het meer ruimte vir die Drukkersafdeling beskikbaar geword wat daardeur 'n aantal nuwe masjiene kon opstel. Dit het tot 'n groot verbetering in die gehalte van die Raad se eie publikasies gelei. Die Drukkers- en Fotografiese Afdelings is sedertien na die Department Tegniese Dienste oorgeplaas waarin hulle nou die Afdeling Grafiese Kunste vorm.

Die afdeling was verantwoordelik vir die reëlings i.v.m. die produseer van 'n dokumentêre film getitel „Kopers wat Keur”—„Trial without Error” in Engels—oor die algemene werk van die Buro vir Standaarde. Die film doen tans die ronde in die Unie. Reëlings is ook getref vir die maak van nog 'n dokumentêre film gebaseer op die Buro se dienste aan die houtnywerheid.

Die Reklamebeampte aan die Buro vir Standaarde verbonde het 53 vergaderings oor die werk van die Buro toegesprek.

Council's laboratories. A companion volume listing all the scientific papers and publications that have originated in the laboratories over the past twelve years is now awaiting distribution. Another pamphlet in the series describing the activities of the national research laboratories is in course of preparation and deals with the National Nutrition Research Institute.

During the year the Division dealt with enquiries about careers in scientific research and employment opportunities in the C.S.I.R. at the rate of three or four a week. To cater for this obvious demand a short pamphlet was drawn up and distributed to schools and other interested organizations. A more comprehensive pamphlet is being prepared. At the request of the Domestic Science Division of the Department of Agriculture a reprint in bound form was made of five articles of particular interest to women published in recent numbers of the *Standards Bulletin*. The Bureau of Standard's *Consumer's Guide* was brought up to date and reissued in a different form.

Apart from the more formal publications, the Division issued some 59 press releases and prepared a number of articles on various aspects of research and standardization for the technical and scientific journals. Considerable assistance was given to the editor of *Lantern* in the production of a trial issue of *Archimedes*, a proposed new journal of science for the schools.

The Division also organized a series of “open days” for both the S.A. Bureau of Standards and the research laboratories at the new site. Arrangements were made for the visits to the laboratories of a number of groups and of individual scientists, including several from overseas.

With the move of the Liaison Division to the new administrative building more space became available for the Printing Section which was able to set up a number of new machines. This resulted in a great improvement in the quality of the Council's internal publications. The Printing and Photographic Sections have since been transferred to the Technical Services Department in which they now form the Graphic Arts Division.

The Division was responsible for the arrangements for producing a documentary film entitled “Trial without Error”—“Kopers wat Keur” in the Afrikaans version—dealing with the general work of the Bureau of Standards. The film is on circuit throughout the Union. Arrangements were also made for the preparation of a further documentary film based on the Bureau's services to the timber industry.

The Public Relations Officer attached to the Bureau of Standards addressed 53 meetings on the work of the S.A. Bureau of Standards.



## AFDELING BEDRYFSEKONOMIE

Gedurende die verslagjaar is lede van die Afdeling se personeel afgestaan aan die Nasionale Bounavorsings-instituut, die Nasionale Padnavorsingsinstituut en die Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese.

Die werk in die Nasionale Bounavorsingsinstituut het in verband gestaan met die bestudering van koste en statistiek met betrekking tot bouwerk en ook met ondersoekings aangaande koste en huurvasstelling in stedelike Bantoevoorgebiede. Laasgenoemde werk word finansiële gesteun deur die Nasionale Behuisingskommissie. Op versoek van die Departement van Naturellesake is 'n ondersoek aangepak in verband met die ekonomiese aspek van watervoorsiening aan stedelike Bantoevoorgebiede volgens 'n metersistiem op die terrein.

Die werk in die Nasionale Padnavorsingsinstituut het in verband gestaan met die langtermynbestudering van die koste aan die bou en onderhoud van paaie in die Unie verbonde.

Die werk vir die Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese het vernameklik verband gehou met 'n opname van die plaaslike mark vir houtkissies wat ten behoeve van die South African Lumber Millers' and Shook Manufacturers' Association uitgevoer is.

Buiten en behalwe die beplanning, ontwikkeling en leiding van projekte in ander onderafdelings van die Afdeling, het die Sentrale Onderafdeling 'n groot aantal navrae van ander W.N.N.R.-institute en -laboratoriums behandel.

## PATENTE-AFDELING

Die patentering van uitvindings deur die navorsings-personeel vereis al hoe meer tyd en aandag. Die moontlikheid word ondersoek om 'n patentontwikkelings-maatskappy te vorm om te verseker dat ontdekkings, uitvindings en verbeterings met betrekking tot prosesse, apparate en masjiene doeltreffend in die openbare belang beskikbaar gestel word.

Op die oomblik het die Raad 20 patente in verskillende stadia van toepassing en kommersiële ontwikkeling. Die geslaagde een was die Tellurometer. Die Kaapstadse firma wat gelisensieer was om hierdie apparaat te vervaardig en te verkoop, was buitengewoon suksesvol wat die produksie, verkoop en lewering aan die meeste dele van die wêreld betref. Die Britse firma wat gelisensieer was om die kommunikasieradio-ontvangstoestel met kristalbeheer te vervaardig en te verkoop, het ook goeie vordering gemaak wat verkopings, produksie en lewering betref.

Na geslaagde proefinstallasiestudies rig die goudmyn-nywerheid tans die grootste installasie ter wêreld op vir die ontsouting van water met gebruikmaking van die elektrodialiseproses, kragtens 'n ingewikkelde reeks ooreenkomste met die W.N.N.R., die Internasionale Groep vir Waterontsouting en 'n Britse firma.

## INDUSTRIAL ECONOMICS DIVISION

During the period members of the Division's staff were attached to the National Building Research Institute, the National Institute for Road Research and the National Mechanical Engineering Research Institute.

The work in the National Building Research Institute was concerned with cost and statistical studies of building operations and also with the investigation related to costs and rent determination in urban Bantu townships. This latter work is sponsored by the National Housing Commission. At the request of the Native Affairs Department an investigation was undertaken into the economics of site metering of water in urban Bantu townships.

The work in the National Institute for Road Research was concerned with the long term study of the costs of road construction and maintenance in the Union.

The work on behalf of the National Mechanical Engineering Research Institute was mainly concerned with a survey of the local market for wooden boxes, which was undertaken on behalf of the South African Lumber Millers' and Shook Manufacturers' Association.

In addition to the planning, development and guidance of projects in the other sections of the Division, the Central Section dealt with a large number of enquiries from other C.S.I.R. Institutes and Laboratories.

## PATENT DIVISION

The patenting of inventions by the research staff is demanding more time and attention. The possibility is being explored of forming a patent development company with a view to ensuring that discoveries, inventions and improvements in respect of processes, apparatus and machines are effectively made available in the public interest.

At present the Council has 20 patents in various stages of application and commercial development. The most successful of these has been the Tellurometer. The Cape Town firm which was licensed to manufacture and sell this equipment has been outstandingly successful in achieving production, sale and delivery to most parts of the world. The British firm which was licensed to manufacture and sell the crystal-controlled communications radio receiver has also made good progress with sales, production and delivery. Following successful pilot plant studies the gold mining industry under a complex series of agreements with C.S.I.R., the International Group for Water Desalting and a British firm, is erecting the largest plant in the world for the demineralization of water using the electrodialysis process.

# Sentrale Werkplaas

*Bestuurder: J. VAN DER STAAY*

Die snelle uitbreiding van die W.N.N.R. stel reeds groter eise sowel kwalitatief as kwantitatief aan die Sentrale Werkplaas, terwyl die verlies aan senior beamptes 'n personeelvraagstuk skep. Daar is besluit om die aantal vakleerlinge te vermeerder om sodoende aan toekomstige eise as gevolg van hierdie uitbreiding die hoof te kan bied. Stappe is ook reeds gedoen om die personeel aan te vul deur instrumentmakers uit die buiteland te werf.

Hieronder volg 'n opsomming van die belangrikste instrumente en apparaat wat vir die Raad gebou is:

Vir die Nasionale Fisiese Navorsingslaboratorium 'n isotoopafskeier, 'n vulapparaat vir die hantering van radioaktiewe stowwe, 'n radar-antenne-opstelling, 'n ionisasiekamer vir X-straalondersoek en 'n heliostaat vir sonligstudies.

Vir die Nasionale Instituut vir Meganiese Ingenieurswese 'n apparaat om die verskuiwing van rotsformasies in myne te kan meet, 'n pneumatiese steenkoolvervoerapparaat en 'n straalpomp om dit aan te dryf, 'n roterende voerapparaat vir lugvervoer van graan en 'n tonnel vir die verweer van metaal en materiaal.

Apparaat vir waterontsouting, 'n monsternemer om neerslae uit riviere en damme te haal, 'n elektroforeseapparaat vir die meting van konsentrasieverhoudings tussen vloeistowwe, en 'n spesiale trekkas om giftige gasse te verwyder, is vir die Nasionale Chemiese Navorsingsinstituut gemaak. Vir die Nasionale Bounavorsingsinstituut: vogtigheidskaste, 'n hystoestel, 'n skuifspanningtoetsapparaat en 'n spesiale oond. 'n Mobiele laboratorium en 'n vibrasietoetsapparaat om die trillings van padoppervlakke te meet, vir die Nasionale Padnavorsingsinstituut; 'n stimulistydmetreer vir die studie van gekondisioneerde reaksies vir die Nasionale Instituut vir Personeelnavorsing; vir die Eenheid vir Navorsing op die gebied van Bitumineuse Bindstof 'n apparaat vir die bepaling van die adhesie van bitumineuse padboumateriaal, 'n houder vir die kunsmatige verwerking van teer en bitumen en 'n apparaat vir die bepaling van vlugtigheidsienskappe van bitumineuse bindstowwe.

Ook buite-instansies beroep hul al hoe meer op die unieke dienste wat die Sentrale Werkplaas in staat is om te lewer. Apparaat en instrumente is vir die Departement van Landbou, die Universiteit van Stellenbosch, die Landboukollege, Potchefstroom, en die Veartsenynavorsingslaboratorium, Onderstepoort, gemaak.

Kapitale toerusting ter waarde van £8,183 is gedurende die jaar vir die Sentrale Werkplaas aangekoop, terwyl die totale kapitale waarde van instrumente, apparaat en meubels wat deur die Sentrale Werkplaas vir die W.N.N.R. vervaardig is, £18,694 15s. 9d. bedra.

Die personeel van die Sentrale Werkplaas bestaan uit 88 blankes en 19 naturelle.

# Central Workshops

*Manager: J. VAN DER STAAY*

The rapid expansion of the C.S.I.R. has led to ever increasing demands, both qualitative and quantitative being made on the Central Workshops, while the loss of senior officers is creating a staff problem. It was decided to increase the number of apprentices in order to cope with future demands resulting from this expansion. Steps have also been taken to complement the staff by recruiting instrument makers overseas.

The following are the most important of the instruments and apparatus constructed for the Council:

For the National Physical Research Laboratory: an isotope separator, a filling apparatus for handling radioactive substance, a radar antennae assembly, an ionisation chamber for x-ray examinations and a heliostat for sunlight studies.

For the National Mechanical Engineering Research Institute: an apparatus for measuring the displacement of rock formations in mines, a pneumatic coal conveying apparatus and a jet pump to actuate it, a rotating feeder for the pneumatic conveyance of grain and a tunnel for aging metals and materials.

For the National Chemical Research Institute: an apparatus for the desalting of water, a sampler to take sediment samples from rivers and dams, an electrophoresis apparatus for measuring the concentration ratios between fluids, and a special fume cupboard to remove poisonous gases.

For the National Building Research Institute: humidity chambers, a lift, a shearing stress test apparatus and a special furnace.

For the National Institute for Road Research: a mobile laboratory and a vibration test apparatus.

For the National Institute for Personnel Research: a stimulus timer for the study of conditioned responses.

For the Bituminous Binders Research Unit: an apparatus for determination of the adhesion of bituminous road construction materials, a container for the accelerated weathering of tar and bitumen, and an apparatus for the determination of the volatile characteristics of bituminous binders.

An increasing number of outside bodies made use of the services the Central Workshops are able to offer. Apparatus and instruments were made for the Department of Agriculture, the University of Stellenbosch, the Agricultural College, Potchefstroom, and the Veterinary Research Laboratory, Onderstepoort.

Capital equipment to the value of £8,183 was purchased for the Central Workshops during the period under review, while the capital value of instruments, apparatus and furniture made by the Central Workshops for the C.S.I.R., amounts to £18,694 15s. 9d.

The Central Workshop's personnel comprises 88 Europeans and 19 Natives.



# Die Suid-Afrikaanse Buro vir Standaarde

*Direkteur: DR. A. W. LATEGAN*

Gedurende die jaar het die uitbreiding wat uit die staanspoor so kenmerkend van die Buro vir Standaarde was, met sulke rasse skrede voorwaarts gegaan dat nog meer persele gehuur moes word in 'n poging om vir afdoende huisvesting te sorg. Bowendien is 'n taklaboratorium in Vereeniging opgerig met die oog op beter dienslewering, veral op die gebied van nie-vernietigende toetswerk, sowel aan die swaar nywerhede in en om Vereeniging en Sasolburg, as aan die Vrystaatse goudmyne.

Noue samewerking met die georganiseerde nywerheid is gehandhaaf en die Buro het sy taak as diensstasie vir die nywerheid na behore vervul. Ook is weer hulp aan staatsdepartemente verleen, en dit stem tot dankbaarheid dat 'n steeds toenemende aantal grootkopers van die geriewe in die Buro se laboratoriums voorhande, vir die toets en keuring van grootskaalse aankope gebruik gemaak het. Nouer samewerking is ook tot stand gebring met die S.A. Spoorwegadministrasie deur die aanstelling deur die spoorweë van 'n Hoofsuperintendent, Handel en Hawens, om as regstreekse skakelbeampte met die Buro op te tree. Onder die konferensies deur Burovertegenwoordigers bygewoon, was dié van die Vereniging van Munisipale en Elektriese Ondernemings en van die Suid-Afrikaanse Nasionale Raad vir Verligting, die Konvensie van die Nasionale Chemiese Instituut en die Markmeesterskonvensie.

Weens die noodsaaklikheid vir samewerking met die Federasie van Rhodesië en Njassaland, is gedurende die jaar verbindings aangeknoop met Rhodesiese staatsministers, sekretarisse van staatsdepartemente, die Voorzitter van die Rhodesiese Kamer van Nywerhede en vooraanstaande nyweraars. Ook is vriendskaplike skakelwerking met die onlangs gestigte Standaardevereniging van die Federasie van Rhodesië en Njassaland bevorder met die doel om eenvormigheid tussen die spesifikasies wat hulle opstel en dié van ons te bewerkstellig. Op uitnodiging van die Direkteur, het die bestuurder van die Standaardevereniging kort nadat hy sy amp aanvaar het, Pretoria en die Buro besoek. Die Direkteur het later 'n teëbesoek aan Salisbury gebring.

Nog 'n belangrike ontwikkeling was die groter mate van hulp aan die gebiede in Afrika besuide die Sahara gelewer, sowel as 'n uitgebreide reeks toetse en inspeksies namens staatsdepartemente en private firmas in Noord- en Suid-Rhodesië en Njassaland, en namens Kroon-agente vir die Kolonies in Londen, onderneem in verband met goedere wat Kenia, Tanganjika en Ghana nodig gehad het.

# The South African Bureau of Standards

*Director: DR. A. W. LATEGAN*

During the year the expansion that has characterized the Bureau of Standards since its inception showed such acceleration that further premises had to be rented in an endeavour to provide adequate accommodation. Furthermore, a branch laboratory was established at Vereeniging with a view to rendering more efficient service, especially in the field of non-destructive testing, to the heavy industries in and around Vereeniging and at Sasolburg, and to the gold mines of the Orange Free State.

Close liaison with organized industry continued and the Bureau's role of service station to industry was well maintained. Continued assistance was given to government departments and it was gratifying to note that an ever increasing number of big buyers made use of the facilities available in the laboratories for the testing and inspection of bulk purchases. Closer liaison was also established with the South African Railways Administration through the appointment by the S.A.R. of the Chief Superintendent, Commercial and Harbours, as direct liaison officer with the Bureau. Among the conferences attended by Bureau representatives were those of the Association of Municipal and Electric Undertakings, and the South African National Council of Illumination, the National Chemical Institute Convention and the Marketmasters' Convention.

In view of the need for co-operation with the Federation of Rhodesia and Nyasaland, contact was established during the year with Rhodesian Ministers of State, secretaries of government departments, the Chairman of the Rhodesian Tender Board, the Chairman of the Rhodesian Chamber of Industries and prominent industrialists. In addition, cordial liaison was promoted with the newly formed Federation of Rhodesia and Nyasaland Standards Association with the aim of encouraging uniformity between the standards drawn up by this Association and those of the Bureau. At the invitation of the Director, the manager of the Standards Association visited Pretoria and the Bureau shortly after he assumed office. This visit was returned in Salisbury by the Director.

A further important development was the increased assistance rendered to territories in Africa, South of the Sahara, a wide range of tests and inspections being undertaken for government departments and private firms in Northern and Southern Rhodesia and Nyasaland, and on behalf of Crown Agents for the Colonies in London on goods required in Kenya, Tanganyika and Ghana.

## DIE STANDAARDERAAD

Die Standaarderaad het ag maal vergader en twee nuwe lede nl. prof. M. N. S. Immelman van die Port Elizabethse Tegnieise Kollege en mnr. I. de Villiers van die Elektrisiteitsvoorsieningskommissie, is aangestel. Die Raad bestaan tans uit:

Dr. S. M. Naudé (*Voorsitter*)  
Dr. V. Bosman  
Prof. M. N. S. Immelman  
Mnr. G. S. J. Kuschke  
Mnr. D. Lion-Cachet  
Dr. H. O. Mönnig  
Brig. J. H. Rauch  
Dr. A. J. A. Roux  
Prof. W. G. Sutton  
Dr. F. J. de Villiers  
Mnr. I. de Villiers

## DEPARTEMENT ANALITIESE EN INDUSTRIËLE CHEMIE

Een van die bemoedigendste aspekte gedurende die jaar was die duidelike neiging in die houtnywerheid om te standaardiseer. Hierdie jaar is vir die eerste keer die Suid-Afrikaanse sagtevrugteoes, op 'n baie klein persentasie na, in kassies uitgevoer wat van Suid-Afrikaanse naaldhout gemaak is, en baie van hulle het die Buro se merk gedra. Die Bosboudepartement het besluit om die standaardmerk sowel op bouhout as op kisplankies aan te bring in 'n poging om te bewys dat Suid-Afrika produkte kan lewer wat nie by die ingevoerde produk agterstaan nie. Alles dui daarop dat private nywerhede besig is om die Departement se voorbeeld te volg.

Nog 'n kenmerk was die toenemende mate waarin die groot aankopers bewus daarvan geword het dat hulle heelwat kan bespaar as hulle volgens betroubare standarde aankoop. Benewens die gebruikelike groot aankope, hetsy volgens die Buro se standarde, hetsy volgens private spesifikasies, deur Suid-Afrikaanse aankopers, is ook aansienlike hoeveelhede skoeisel en kreosoot behandelde telefoon- en kragooringingspale wat die merk dra, deur ander lande in Afrika, selfs so ver weg as Uganda gekoop.

### Hout

Die opvallendste kenmerk was die verlening van toestemming aan vyf staatsaagmeule om die merk op hulle bouhout, en aan ses om dit op hul kisplankies aan te bring. Dit is onlangs gevolg deur 'n reeks aansoeke van vyf private ondernemings vir toestemming om die merk

## STANDARDS COUNCIL

Eight meetings of the Standards Council were held and two additional members, namely, Prof. M. N. S. Immelman of the Port Elizabeth Technical College and Mr. I. de Villiers of the Electricity Supply Commission were appointed. The present membership of the Council is:

Dr. S. M. Naudé (*Chairman*)  
Dr. V. Bosman.  
Prof. M. N. S. Immelman.  
Mr. G. S. J. Kuschke.  
Mr. D. Lion-Cachet.  
Dr. H. O. Mönnig.  
Brig. J. H. Rauch.  
Dr. A. J. A. Roux.  
Prof. W. G. Sutton.  
Dr. F. J. de Villiers.  
Mr. I. de Villiers.

## ANALYTICAL AND INDUSTRIAL CHEMISTRY DEPARTMENT

One of the most encouraging aspects during the year was the marked trend in the timber industry towards standardization. This year, for the first time, except for a very small percentage, the South African deciduous fruit crop was exported in boxes made from South African softwood, many of them bearing the Bureau's mark. The Department of Forestry has decided to apply the standardization mark to structural timber as well as to box shooks in an effort to prove that South African timber is as good as the imported product. Indications are that private industry is following the example set by the Department.

A further feature was the growing recognition by big buyers of the savings that can be effected if their purchases are made to reliable standards. In addition to the usual large purchases made by South African buyers to the Bureau's standard or private specifications, considerable quantities of footwear and creosoted telephone and transmission poles bearing the mark were bought by neighbouring African countries as far afield as Uganda.

### Timber

The outstanding feature was the granting of the mark to five state saw mills for structural timber and to six for box shooks. This has been more recently followed by a series of applications for the mark on structural timber from five private organizations. Between them the private



op bouhout te gebruik. Al die private meule tesame lewer ongeveer 30 persent van die land se totale verbruik aan hier te lande gekweekte uitheemse naaldhout.

Nog 'n ontwikkeling was dat twee van die groot fabrikante van houtstele, wat waarskynlik drie kwart van die stele lewer wat uit plaaslik gekweekte uitheemse en inheemse loofhoutsoorte hier te lande geproduseer word, aansoek gedoen het om toestemming om die merk op verskeie soorte houtstele aan te bring.

Daartoe aangemoedig deur die Suid-Afrikaanse Spoorwegadministrasie en die Kamer van Mynwese (twee van die grootste gebruikers van houtstele vir verskillende soorte gereedskap) is, met medewerking van die ver naamste houtsteelfabrikante, standaardspesifikasies opgestel wat 12 soorte stele dek. Op die oomblik word die meeste stele wat hier gebruik word, van ingevoerde hickory (*Carya* spp.) of essehout (*Fraxinus* spp.) gemaak. Dit is hoofsaaklik aan die feit toe te skrywe dat die plaaslike stele wat in 'n ongegradeerde vorm aangebied word en wat partykeer uit hout wat ongeskik vir stele is, gemaak word, met die gegradeerde, ingevoerde stele wat uit erkende houtsoorte vir stele, nl. hickory en essehout, gemaak is, moes konkurreer.

Die geringe vraag na gegradeerde vloerplanke is te wyte aan 'n gebrek aan onderskeidingsvermoë van die kant van die gewone koper, wat blykbaar verkies om 'n goedkoper, ongegradeerde artikel te koop, omdat hy dink dat dit 'n besparing is. In werklikheid verloor hy miskien geld by die transaksie.

Die vyf bogenoemde staatsaagmeule is besig met die produksie van groot bestellings bouhout wat die merk dra. Een beampte van die Departement van Openbare Werke het gesê dat 'n verbetering van kwaliteit onmiddellik opgemerk is. Die sykante van 'n groot aantal spoorwegveetrotte word van planke van 7 vt. 6 dm. tot 16 vt.  $\times$   $7\frac{1}{2} \times 1\frac{1}{2}$  dm. en  $7\frac{1}{2} \times 2\frac{1}{2}$  dm. gemaak, d.w.s. uit materiaal wat tot nog toe grotendeels uit dollarlande ingevoer is. Die werksmense wat die hout gebruik, is tevrede en party van hulle was verbaas dat daar sulke goeie Suid-Afrikaanse dennehout bestaan.

Twaalf standaardspesifikasies vir stele (vir pikke, kloppikke, bylpikke, skopgrawe, grawe, harke, skoffels, besems, byle, handbyltjies en hamers) is voltooi. Nege is reeds gepubliseer en die vir byl-, handbyltjie- en hamer-stele nader voltooiing. Die Suid-Afrikaanse Spoorwegadministrasie en sekere mynmaatskappye het te kenne gegee dat hulle graag stele wat hier te lande vervaardig is, sal gebruik sodra die merk daarop aangebring is.

Die spesifikasie vir plankies vir sitruskissies en die hersiene spesifikasie vir hout vir boudoeleindes is voltooi.

Die nuwe spesifikasies vir kreosote (twee) en vir houtverduursamingsmiddels met 'n basis van kreosoot (vyf) is voltooi en gepubliseer. Hierdie spesifikasies voorsien in 'n lank gevoelde, dringende behoefte, en dien ter

mills supply about 30 per cent of the country's total consumption of locally grown exotic softwoods.

A further development was the application for the use of the mark on several types of wooden handles by two of the three big handlemakers, which probably supply three-quarters of the country's output of handles made from locally grown exotic and indigenous hardwoods.

With the encouragement of the South African Railways Administration and the Chamber of Mines (two of the largest consumers of wooden handles for various tools) together with the principal manufacturers of wooden handles, standard specifications were completed covering 12 types. At present most of the handles in use are those of imported hickory (*Carya* spp.) or ash (*Fraxinus* spp.). This is in part due to the fact that the local handles offered in an ungraded form and sometimes manufactured from wood unsuitable as handle species, have had to compete with the graded imported handles manufactured from recognized handle species, namely, hickory and ash.

The small demand for graded flooring can be ascribed to a lack of discrimination on the part of the ordinary buyer, who apparently prefers to buy a cheaper unguaranteed article believing this to be a saving. He may in actual fact be losing money on the purchase.

Large deliveries of mark-bearing structural timber from the five state saw mills mentioned above are in progress. One Public Works Department official has stated that a rise in quality was immediately noticeable. The sides of a large number of railway cattle trucks are being made of 7 ft. 6 in.  $\times$  7  $\frac{1}{2}$   $\times$  1  $\frac{1}{2}$  in. and 7  $\frac{1}{2}$   $\times$  2  $\frac{1}{2}$  in. pieces, in other words, from material that up to now has been largely imported from dollar areas. Reports by artisans using the wood are satisfactory. Some of them have expressed surprise at finding such acceptable South African pine.

Twelve standard specifications for handles (pick, beater pick, mattock, shovel, spade, rake, fork, hoe, broom, axe, hatchet and hammer) were completed. Nine have already been published and those for axe, hatchet and hammer are almost completed. The South African Railways Administration and certain mining houses have indicated that they would like to use local handles as soon as these carry the mark.

The specification for citrus shooks and the revised specification for building timber have been completed.

The new specification for creosotes (two) and for wood preservatives with a creosote basis (five) were completed and published. These fill an urgent need of many years standing and will replace the emergency grade creosote which had been specified and used since 1952.

The rapid pace at which the timber industry is advancing can be gauged from the fact that during 1956/57 £6,555,000 worth of locally grown sawn wood (nearly all

vervanging van die noodgraad kreosoot wat sedert 1952 gespesifiseer en gebruik is.

Die vinnige tempo waarteen die houtnywerheid vooruitgaan, blyk duidelik uit die feit dat gedurende 1956/57 vir 'n bedrag van £6,555,000 hier te lande gekweekte, opgesaagte hout (amper alles naaldhout) verkoop is, d.w.s. £1½ miljoen meer as in 1954/55.

Hoewel die keuring van houtmeubels tans deur die Afdeling Siviele Ingenieurswese behartig word, het die Onderafdeling Hout nog tydens die oorgangstadium die aanname-inspeksies gedoen. Meubels ter waarde van £90,000 is gedurende die jaar gekeur.

Groot hoeveelhede met kreosoot behandelde telefoon- en kragoorbringingspale word gereeld na gebiede benoorde die Limpopo uitgevoer, en onlangs is 'n lading elektriese-kragpale, 45 vt. lank en 9 dm. dik aan die dun ent, na Uganda versend.

Hierdie onderafdeling besit nou meer as 1,500 botaniese geverifieerde standaardmonsters van belangrike houtsoorte van oor die hele wêreld. Die versameling is egter nog nie volledig nie en nuwe houtsoorte word steeds daaraan toegevoeg namate hulle ontvang word. Hulle word tans geklassifiseer, in 'n indeks aangeteken en gebêre.

#### **Leer en Skoeisel**

Die werksaamhede van hierdie Onderafdeling het weer aansienlik toegeneem. Bewys hiervan is die groot aantal monsters wat van ander organisasies ontvang en vir hulle getoets is. Die getoetste monsters het bestaan uit buitesooller, skoeisel, verskillende soorte leer en sellulose-veselbord vir gebruik in skoeisel, bolear, en talryke skoeiselonderdele. Die groot aantal monsters vir ondersoek ingestuur, bewys dat daar al hoe meer belangstelling deur die skoeisel- en leernywerhede getoon word vir die bevredigende gebruik van surrogaatmateriale. Sowel hier te lande as oorsee is die mening uitgespreek dat daar meer eenvormigheid in die leer wat geproduseer word, sal moet wees, wil dit met sukses konkurreer met die baie eenvormige soorte leerbord uit ou leer vervaardig en ander surrogaat wat aan skoefabrikante aangebied word.

Op die gebied van aanname-inspeksies het ook 'n duidelike toename in die werk plaasgevind. Spesiale melding behoort in verband hiermee gemaak te word van die nuwe tipe offisiersskoene wat deur die Buro vir die Departement van Verdediging ontwerp is. Die betrokke offisiere het almal hul tevredeheid met hierdie skoene te kenne gegee, en die steeds volgehoue goeie kwaliteit van sowel die materiaal as die uitvoering wat by besendings van hierdie skoene opgemerk is, is baie bemoedigend, veral in die lig van die nadruk wat die Buro altyd op die feit lê dat staatsdepartemente artikels van goeie kwaliteit behoort te koop. Ander tipes skoeisel

(softwoods) was sold, which was an increase of £1½ million over 1954/55.

Although wooden furniture inspection now falls under the Civil Engineering Division, the Section continued to make acceptance inspections to cover the transition stage. Furniture totalling £90,000 was inspected during the year.

Large quantities of creosoted telephone and transmission poles are being regularly exported to territories north of the Limpopo, a shipment of electric power poles 45 feet long and 9 inches at the thin end, being recently sent to Uganda.

The Section now possesses over 1,500 botanically verified standard samples of important world woods. The collection is, however, not complete and new woods are being constantly added as obtained. Their classification, indexing and casing is now in hand.

#### **Leather and Footwear**

The activities of this Section again expanded considerably. Evidence of this is the large number of samples received from and tested for outside organizations. The samples tested comprised outer sole leather, footwear, various types of leather and cellulose fibreboards for use in footwear, upper leather, and numerous footwear components. Increased interest in satisfactory use of substitute materials from the side of the footwear and leather industries could be observed by the large number of samples submitted for testing. The opinion has been expressed both in this country and overseas that leather will have to be made more uniformly if it is to compete successfully with the very uniform types of reconstituted leather board and other substitutes offered to footwear manufacturers.

In the field of acceptance inspections a marked increase in activities could also be noted. Special mention should be made under this heading of the new type of officers' shoes developed by the Bureau for the Department of Defence. This new shoe has met with the general approval of the officers concerned and the consistently high quality of both materials and workmanship found in deliveries of these shoes has been very encouraging, especially in the light of the emphasis laid by the Bureau on the fact that quality articles should be purchased by state departments. Other types of footwear inspected and accepted by the Section were: various



deur die Onderafdeling gekeur en aangeneem was: verskillende soorte stewels, skoene en sandale deur die Suid-Afrikaanse Seemag gedra, verskillende soorte skoeisel deur staatsdepartemente en inrigtings gebruik (namens die Unieraad vir Tenders en Leweransies); spesifieke soorte skoeisel deur die S.A. Spoorweg-administrasie gebruik; en mynwerkerstewels (vir die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese).

Die opstelling en hersiening van spesifikasies vir skoeisel en materiaal vir onderdele van skoeisel het bevredigend gevorder. Spesifikasies wat gedurende die onderhawige tydperk voltooi is, dek o.a. die volgende: mynwerkerstewels, veiligheidskoene, beskermende skoene en stewels, en konsepdokumente is opgestel vir kinderskoene, rangeerderskoene, skoolskoene vir seuns, skoolskoene vir dogters, e.a. Konsep-spesifikasies vir leer omvat die volgende: veterleer en leerveters, tuie- en toomleer, hidrouliese leer, randnaaileer en ander. Massaondersoek van monsters bolear vir uiteindelijke opstelling van spesifikasies vir verskillende tipes bolear word ook nog steeds gedoen.

Die aanskaffing uit die buiteland van nuwe soorte toetstoerusting vir hierdie doel, sal die Onderafdeling help om die bestek van sy werksaamhede uit te brei. Die geriewe wat hierdie Onderafdeling aan die skoeiselnywerheid bied in verband met die gebruik van die standaardmerk vermeerder ook namate meer spesifikasies klaarkom. Dit beteken dat die verskeidenheid skoeiseltipes wat onder die standaardmerkskema val, steeds toeneem.

'n Paar fabrikante wat die allerbeste soort manskoene in die land vervaardig, het die mening uitgespreek dat hulle die aanbring van die S.A.B.S.-merk op hul skoene, benewens hul eie welbekende en erkende handelsmerke, as 'n bate beskou, wat beteken dat hulle die baie streng kwaliteitsbeheer deur die Buro vereis, verwelkom. Elf aansoeke om toestemming tot gebruik van die merk op hul skoeisel en een dergelyke aansoek i.v.m. bedryfshandskoene is gedurende die onderhawige tydperk ontvang.

Kontrolemonsterneming en -ondersoek volgens die verpligte spesifikasie vir buitesooller vind nog steeds plaas en die voorgestelde wysigings aan hierdie spesifikasie is onder normale gebruiksomstandighede deur die verskillende looierye in die land op die proef gestel. Die gewysigde spesifikasies nader voltooiing.

### **Metallurgie**

Die talryke versoeke om hulp deur hierdie Onderafdeling ontvang, van die Transvaalse Administrasie, Departement van Pos-en-Telegraafwese, Unietenderraad, Krygsproduksiekantoor, Suid-Afrikaanse Polisie, die juweliersbedryf, en die nywerheid in die algemeen, toon duidelik in watter mate daar van sy dienste gebruik gemaak word en vorm 'n maatstaf van die waarde van hierdie dienste vir die land.

types of boots, shoes and sandals worn by the South African Naval Forces, various types of footwear used by state departments and institutions on behalf of the Union Tender Board and Supplies Office; specific types of footwear used by the South African Railways Administration; and on miners' boots on behalf of the Transvaal and Orange Free State Chamber of Mines.

Progress made with the preparation and revision of specifications for footwear and footwear component materials was satisfactory. Specifications completed during this cycle comprised: miners' boots, safety shoes, protective shoes and protective boots, while draft documents were prepared for childrens' shoes, shunters' shoes, boys' and youths' school shoes, maid's and girls' school shoes and others. Draft specifications for leather comprised: lacing leather and leather laces, harness and bridle leather, hydraulic leather, leather welting and others. The mass testing of samples of upper leather for eventual preparation of specifications for various types of upper leather is also continuing.

The acquisition from overseas of newly developed testing equipment for this purpose will assist the Section in extending this field of activities. The facilities offered by this Section to the footwear industry in regard to the application of the standardization mark are widening as more standard specifications reach completion. This means that the variety of footwear types covered by and controlled under the standardization mark scheme is ever increasing.

Some manufacturers producing the highest grades of mens' shoes in the country have expressed the opinion that they consider the application of the S.A.B.S. mark to their shoes in addition to their own well-known and accepted brand names an asset, thereby signifying that they welcome the very strict quality control required by the Bureau. Eleven applications to apply the mark to footwear and one to industrial gloves were received during the period under review.

Control sampling and testing against the compulsory specification for outer sole leather was continued and the proposed amendments to this specification were tried out under normal practice by the various tanneries in this country. The amended specifications are nearing completion.

### **Metallurgy**

The heavy demand for the Section's services by the Transvaal Administration, Department of Posts and Telegraphs, Union Tender Board, Defence Production Office, South African Police, the jewellery trade, and industry in general, can be taken as an indication of the extent to which these services are now used and as a gauge of their national value.

Die onderafdeling beskik oor twee laboratoria: die een ingerig om metallurgiese ondersoeke en toetse uit te voer, en die ander om samestellings d.m.v. chemiese ontleding te bepaal. Primêre metale, ou-metaal, en gieterylegerings by metaalmenging gebruik, halfafgewerkte en afgewerkte produkte soos konvensionele gietstukke en vormgietstukke, persprofiële en gewalste profiële, smeedstukke, trekstukke, stampstukke, persstukke, masjienonderdele en vervaardigde konstruksies was onder die groot verskeidenheid materiale en produkte wat ondersoek, getoets en ontleed is.

Baie van die werk het bestaan in kontrolering volgens die merkskema en die aanname-inspeksieskema. Ingevolge die merkskema is die gespesifiseerde eienskappe van die volgende, wat deur 75 perмите in die geheel gedek word, gekontroleer: ferrometale, witmetale, drukkersmetale, sagte soldeersels, goue artikels en sterlingsilwer. Die gespesifiseerde eienskappe van duisende kentekens en knope vir die leër en die polisiesmag, en van soldeerharpus vir die Departement van Pos-en-Telegraafwese is ingevolge die aanname-inspeksieskema gekontroleer.

Hulp is aan fabrikante en verbruikers verleen deur ondersoek in te stel na weiering van onderdele tydens gebruik, die oorsake van korrosie en deur die vergeelyking van die eienskappe van hier te lande vervaardigde produkte met dié van soortgelyke ingevoerde produkte.

#### **Analitiese Chemie**

Hierdie onderafdeling het heelwat meer versoeke ontvang om toetse en ontledings uit te voer op 'n groter verskeidenheid artikels as ooit tevore, soos o.a. porselein-aarde, seep, dierlike lym, eter vir verdowingsdoeleindes, stoep-, vloer- en skoenwakse, sout, kopersulfaat, water, distikstofoksied, paraffienwas, houtverduursamingsmiddels, silwerpolitoer, gliserol, dolomiet, kalkswawel, walvisolie, sand, natriumsulfaat en tabak.

Belangrike dienste is by twee geleenthede gelewer toe die onderafdeling op versoek van 'n fabrikant van mediese gasse, kort tydperke gehelp het by die kontrolering van die produksie van distikstofoksied en suurstof.

Monsters sagte seep, toiletseep en vloeibare toiletseep is dwarsdeur die jaar ingevolge die aanname-inspeksieskema vir die Suid-Afrikaanse Spoorwegadministrasie getoets.

Die spesifikasie vir vloeistof vir die merk van skape nader voltooiing. Daar is besluit om alleen veldtoetse uit te voer om die gemak van aanwending, leesbaarheid en uitwasbaarheid te bepaal, en daar is gereken dat hierdie toetse die belangrikste vereistes sou dek. Gedurende die jaar is 'n katodestraal polarograaf deur die Fisies-Chemiese Onderafdeling aangeskaf wat die werk baie vergemaklik het. Hierdie instrument is 'n onlangse verbetering van die konvensionele polarograaf waarbo dit verskeie voordele het, soos byvoorbeeld die polarogram word regstreeks

The Section comprises two laboratories, one of which is equipped to carry out metallurgical examinations and tests, and the other to determine compositions by chemical analysis. Virgin metals, scrap metal and master alloys used in foundry "make up", semi-finishes and finished products such as conventional castings and die-castings, extruded and tolled sections, forgings, drawings, stampings, pressings, machinery components, and fabricated structures were among the great variety of materials and products examined, tested and analysed.

Much of the work consisted of control testing under the mark scheme and the acceptance inspection scheme. Under the mark scheme, control testing of the specified qualities covered by a total of 73 permits in respect of ferro metals, white metals, printers metals, soft solders, gold ware and sterling silver ware was carried out. The specified qualities of thousands of badges and buttons for the Army and the Police Force, and of rosin-cored solder for the Department of Posts and Telegraphs, were controlled under the acceptance inspection scheme.

Assistance was rendered to manufacturers and consumers by means of investigations into failures of components in service, the causes of corrosion and by comparison of the qualities of locally manufactured products with those of similar imported products.

#### **Analytical Chemistry**

The Section experienced a considerable increase in the number of requests for tests and analyses on an even wider variety of commodities than in previous years, among them china clay, soap, animal glue, anaesthetic ether, stoep, floor and boot polishes, salt, copper sulphate, water, nitrous oxide, paraffin wax, timber preservatives, silver polish, glycerol, dolomite, lime sulphur, whale oil, sand, sodium sulphate and tobacco.

Important services were rendered on two occasions, when, for short periods, at the request of a manufacturer of medical gases, the Section assisted in the control of the production of nitrous oxide and oxygen.

Samples of soft soap, toilet soap and liquid toilet soap were tested for the South African Railways Administration under the acceptance inspection scheme throughout the year.

The specification for sheep marking fluid reached completion. It was decided to carry out field tests only for determining ease of application, legibility and scourability, as it was considered that these would adequately cover the most important requirements. During the year under review a cathode ray polarograph was obtained by the Physico-Chemical Section and has greatly facilitated the work. It is a recent improvement on the conventional polarograph over which it has several advantages, for example, the polarogram is obtained direct, which results



verkry wat tot 'n besparing van 10 tot 15 minute op elke bepaling lei; dit is gevoeliger, waardeur laer konsentrasies noukeuriger bepaal kan word; dit maak die bepaling van klein konsentrasies van 'n gegewe ioon in aanwesigheid van groot hoeveelhede van 'n ioon wat by 'n meer positiewe potensiaal reduseer, moontlik. Die groot verskeidenheid werk deur die Onderafdeling Fisika-chemie gedoen, toon duidelik hoe waardevol en veelsydig hierdie instrument as ontledingmiddel is. Die handelsartikels wat daarmee getoets is, omvat petrol, koper-naftenaat, katoenseildoek, terapeutiese stowwe, tamatiepasta en houtverduursamingsmiddels.

### Spektrochemie

Die werk van hierdie onderafdeling kan in drie kategorieë onderverdeel word, nl. spektrografiese, spektrofotometriese en x-straaldiffraksie-analises.

Spektrografiese metodes word gewoonlik vir die bepaling van onsuiverhede in verskillende metale en legerings gebruik. Gedurende die onderhawige tydperk is hulle gebruik by die toets van lood en lood-legerings, aluminium- en koperplaat, draad en gietstukke, alsmede vir die kontrole-analise van witmetaal, drukkersmetaal, soldeersels en kabellood, ingevolge die merkskema. Dit het geblyk dat die spektrografiese ontledingmetode goedkoper is as die nat-chemiese metode.

Kwalitatiewe spektrografiese analises vir ander afdelings van die Buro is op talryke monsters, sowel as op hofbewysstukke van die Suid-Afrikaanse Kriminele Buro gedoen.

Spektrofotometriese bepalinge is op insektmiddels (hoofsaaklik D.D.T. en B.H.C.), swamdoders en houtverduursamingsmiddels gedoen; laasgenoemdes in oplossing sowel as op die behandelde hout.

Gedurende die jaar is 'n chromatografiese gasapparaat geïnstalleer vir gebruik saam met die infrarooi-spektrometer vir die ontleding van organiese mengsels, soos oplossingsmiddels, gasmengsels en petroleumprodukte. Hierdie metodes het waardevol geblyk in gevalle waar chemiese metodes of te duur, of te tydrowend of onmoontlik sou gewees het.

X-straaldiffraksie-metodes is sowel vir die ontleding van stof in fabrieksatmosfere gebruik, as vir die ontleding van monsters vir die S.A. Kriminele Buro, soos vreemde stowwe in die oliebakke van motorvoertuie gegooi in gevalle van sabotasie.

### Rotse en Kleiprodukte

Die werk het nog steeds die toets van vuurvaste materiaal, breekgoed, messe en ander produkte omvat en 'n aantal monsters vuurvaste stene is ten behoeve van die S.A. Spoorwegadministrasie getoets in verband met die plasing van hul jaarlikse kontrak vir vuurvaste stene. Die verdere toets van vuurvaste stene is bestudeer en nuwe, noukeuriger apparate is aangeskaf. Een van hierdie masjiene,

in a saving of from 10 to 15 minutes on each determination; it has greater sensitivity, enabling lower concentrations to be determined with greater accuracy; it enables determinations of small concentrations of a given ion to be made in the presence of large amounts of an ion, reducing at a more positive potential. The widely varied work carried out by the Physico-Chemical Section indicates the value and versatility of this instrument and the means of analysis it provides. Among the commodities tested with its aid were petrol, copper naphthenate, cotton duck, therapeutic substances, tomato paste and timber preservatives.

### Spectrochemistry

The work of the Section can be divided into three categories, namely, spectrographic, spectrophotometric and X-ray diffraction analyses.

Spectrographic methods are generally used for determining impurities in various metals and alloys. During the period reviewed they were used in the testing of lead and lead alloy, aluminium and copper plate, wire and castings as well as for the control analysis of white metal, printers' metal, solders and cable lead, under the mark scheme. It was found that by using the spectrographic method of analysis considerable savings could be effected as compared with the wet chemical method.

Qualitative spectrographic analyses for other sections of the Bureau were conducted on large numbers of samples, as well as on exhibits for the South African Criminal Bureau.

Spectrophotometric determinations were done on insecticides (mainly DDT and BHC), fungicides and timber preservatives, the latter in solution as well as on treated wood.

During the year, a gas chromatographic apparatus was installed for use in conjunction with the infra-red spectrometer, for the analysis of organic mixtures such as solvents, gas mixtures and petroleum products. These methods proved valuable in cases where chemical methods would have been either too expensive, taken too long, or would not have been possible.

X-ray diffraction methods were used for the analysis of dust in factory atmospheres, as well as for the analysis of samples for the South African Criminal Bureau, such as foreign material introduced into the sumps of motor vehicles in cases of sabotage.

### Rock and Clay Products

Work on refractories, crockery, cutlery and other products continued, and a number of samples of firebricks were tested on behalf of the South African Railways Administration in connection with the placing of their annual contract for firebricks. Study was devoted to the further testing of firebricks and new and more accurate apparatus was acquired. One of these machines, namely

naamlik die nuwe apparaat vir die toets van vuurvastheid onder belasting, wat baie noukeuriger meting en temperatuurkontrolle moontlik maak, het van groot waarde geblyk.

### **Rubber en Plastika**

Die toetswerk van hierdie twee onderafdelings het geleidelik toegeneem. Oor die afgelope 3 jaar het die aantal verslae deur die Onderafdeling Rubber uitgebring met 53 persent toegeneem in vergelyking met verslae uitgebring gedurende die eerste drie jaar van sy bestaan, terwyl die syfer vir die Onderafdeling Plastika 'n toename van 107 persent toon.

Daar word so baie nuwe produkte hier te lande gemaak dat die versoeke om die opstel van spesifikasies, en veral private spesifikasies wat vinnig afgehandel kan word, nie nagekom kon word nie.

In die loop van die jaar het 'n senior beampte oorsese lande besoek en die jongste tegniese inligting wat vir hierdie onderafdelings van nut kon wees, versamel.

### **Plastika**

Wat spesifikasiewerk betref is die spesifikasie vir swart poliëtileenwaterpype voltooi en is verder gewerk aan die spesifikasies vir PVC-tuinslange, PVC-vloerteëls, die hersiening van die spesifikasie vir kables met PVC-isolering, en 'n groot verskeidenheid private spesifikasies met inbegrip van dik PVC-gordyne vir hospitale, linoleumbelvoeringsmateriaal, poliëtileenbierbekers vir munisipale biersale en plastiekeetgerei vir hospitaalgebruik.

Afmetingsvereistes vorm 'n belangrike deel van bewerkte plastiekvoorwerpe wat gevorm of gepers is, en wat dit, sowel as wat die kwaliteitsvereistes betref, is die publikasie van die spesifikasie vir poliëtileenwaterpype deur die nywerheid sowel as die verbruikers verwelkom.

Nog 'n belangrike sy van die werk i.v.m. plastiek-materiale is die invloed van omgewingsfaktore en die korrelering van laboratorium- en lewensduurtoetse. Dit maak nougesette kontrolering van toetstoestande en die ontwerp van spesiale toetstoerusting noodsaaklik. Die wêreldwye gebrek aan tegniese gegewens omtrent hierdie probleem en die bepaalde moeilikhede in suidelike Afrika ondervind sou 'n goeie navorsingsonderwerp vorm. Hierdie belangrike sy is weerspieël in die toetswerk-saamhede van die onderafdeling, wie se werk vir 70 persent uit die toets van plastiekisoleringmateriaal bestaan het. Werk is ook gedoen op poliëtileenbottels en -velle, draad met plastiekomhulling, weefstowwe met PVC beklee, beskermende klere, plastiekgordyne, kunsmarmer, vormstukke met glas versterk, en ditto vloerteëls.

Gereelde inspeksies is uitgevoer op PVC-houers vir bewysboekies en op deursigtige plakband vir die Sentrale Bewysburo vir Naturellesake.

the new apparatus for testing refractories under load which allows much more accurate measurement and temperature control, has proved of great assistance to the Section.

### **Rubber and Plastics**

The testing activities of these two Sections showed a steady increase. Over the past three years the number of reports issued by the Rubber Section has increased by 53 per cent as compared with reports issued during the first three years, while the figure for the Plastics Section showed an increase of 107 per cent.

So many new products are being manufactured locally that the requests for specifications, especially private specifications which can be quickly dealt with, could not all be complied with.

During the year a senior officer visited overseas countries and obtained the latest technical information relevant to these Sections.

### **Plastics**

Specification work entailed completion of the specification for black polyethylene water piping, and progress on the specifications for P.V.C. garden hose, P.V.C. floor tiles, revision of the specification for P.V.C. insulated cables. A wide variety of private specifications included thick P.V.C. curtains for hospitals, linoleum flooring, polyethylene beer mugs for municipal beer halls and plastic crockery for hospital use.

Dimensional requirements constitute an important part of processed plastic articles which are either moulded or extruded and, in this respect, as well as for quality requirements the publication of the specification for polyethylene water piping was well received by industry and consumers.

Another important feature of plastic materials is the effect on environmental agents and correlation of laboratory and life tests. This feature calls for meticulous control of test conditions and the designing of specialized test equipment. The world-wide lack of technical data on this problem and the particular difficulties experienced in Southern Africa could well form a subject for research. The influence of this feature was reflected in the testing activities of the Section in that the bulk of the test work undertaken (70 per cent) was on plastic insulating material. Work was also done on polyethylene bottles and sheet, plastic coated wires, P.V.C. coated fabrics, protective clothing, plastic blinds, artificial marble, glass reinforced mouldings and floor tiles.

Regular inspection was done on P.V.C. containers for reference books and on transparent adhesive tapes for the Native Affairs Central Reference Bureau.



## Rubber

Die spesifikasies vir materiale vir die herbou van bande, die hersiening van die spesifikasie vir rubberstewels, V-bande en private spesifikasies vir laboratoriumbuise en proppe en vaksienproppe, mediese buise, rubbermatrasse, handskoene vir chirurgie, rubberdoek en polisie-stokke is deur die verskillende ontwikkelingsstadia geloods.

Probleme het ontstaan in verband met slytasietoetse op versoorde bande en daar is besluit dat vedere korreleringswerk deur hierdie onderafdeling gedoen moet word.

Die hersiening van die spesifikasie vir rubberstewels is onderneem ten einde voorsiening vir nog ander tipes te maak. Om te verseker dat die kwaliteit van die addisionele tipes tenminste net so goed is as dié van die ouer aanneemlike tipes, word prestasietoetse deur verbruikers-organisasies uitgevoer onder toesig van die Buro.

Die ontwerp- en konstruksie-aspekte van poliesiestokke is bevredigend opgelos met behulp van monsters en inligting deur die Suid-Afrikaanse Polisie en die Buro verkry.

Toetswerkzaamhede het baie gebiede gedek waarvan die volgende lys verteenwoordigend is- rubbersole en -hakke; geïsoleerde kables; bande; herwonne rubber; spoorwegisoleerkussings; pakstukke en ringe; rubberhaar; kruisbande van elastiese touweefsel vir gebruik deur beampies wat 'n uniform dra.

## Petroleum, Brandstowwe en Smeermiddels

Die spesifikasieprogram van hierdie onderafdeling het o.a. 'n belangrike plaaslik vervaardigde produk omvat, nl. vloeibaar gemaakte petroleumgas. Die nywerheid streef daarna om 'n gas van die allerbeste kwaliteit te produseer wat die doeltreffende werking van 'n baie groot verskeidenheid masjiene en installasies oor die hele suidelike Afrika sal verseker.

Daar is goed gevorder met die spesifikasies vir staalkabelsmeermiddels en transformatorolie.

Die toetswerkzaamhede van hierdie onderafdeling het met ongeveer 30 persent toegeneem en het opdragte van staatsdepartemente, munisipaliteite, die Britse Ministerie van Voorrade, oliemaatskappye, boere wat aan landbou-koöporasies behoort, en ander private persone omvat. Hierdie en baie ander organisasies word al hoe meer bewus van die Buro se werkzaamhede en die geriewe wat hulle op die gebied van petroleumondersoek beskikbaar stel.

Kontrolering van die kwaliteit van produkte wat ingevolge die merkskema vervaardig word, het 'n groot gedeelte van die toetswerk uitgemaak. Nieu samewerking met die nywerheid het daartoe gelei dat baie versoeke om roetinekontrolering van produkte in die verskillende stadia van ontwikkeling ontvang is.

Baie toetse is ook vir ander afdelings van die Buro

## Rubber

The specifications for materials for the reconditioning of tyres, revision of the specifications for gum boots and V-belts, private specifications for laboratory tubing and stoppers and vaccine stoppers, medical tubing, rubber mattresses, surgeons' gloves, rubberized cloth and police batons, were taken through various stages of development.

Problems arose in connection with abrasion tests on retreaded tyres and it was decided that further correlation work should be done by the Section.

The revision of the specification for gum boots was undertaken in order to provide for further types. To ensure that the quality of the additional types is at least equal to the older acceptable types, performance tests are being done by consumer organizations under the control of the Bureau.

The design and construction aspects of police batons was satisfactorily settled with the aid of samples and information obtained by the South African Police and the Bureau.

Testing activities covered many fields of which the following list is representative: rubber soles and heels, insulated cable, tyres, reclaimed rubber, railway insulating pads, gaskets and rings, rubberized hair and elastic webbing braces for use by uniformed officials.

## Petroleum, Fuels and Lubricants

The specification programme of this Section included an important locally produced product namely, liquefied petroleum gas. The industry's aim is to produce a gas of the highest possible quality which will ensure efficient operation of a very wide variety of units and installations all over Southern Africa.

Good progress was made with the specifications for wire rope lubricants and transformer oil.

The testing activities of this Section increased by some 30 per cent and included requests from government departments, municipalities, the British Ministry of Supply, oil companies, and agricultural co-operatives, farmers and other individuals. These and many other organizations are becoming increasingly aware of the Bureau's activities and the facilities it can offer in the field of petroleum testing.

The control of the quality of products manufactured under the mark scheme involved a large proportion of the testing done. The close liaison with industry resulted in many requests for routine checking of products in various stages of development.

gedoen en het die ondersoek van insektemiddels, verf, oplosmiddels, voedsel, lym, rubberdoppies en oliefilters omvat.

### Verf

Die volgende private spesifikasies is opgestel: 'n spesifikasie vir padmerkverf vir die Unieraad vir Tenders en Leweransies, twee spesifikasies vir 'n grondverf en 'n emaljedekverf vir gereedskap vir 'n plaaslike fabrikant, en 'n spesifikasie vir aluminiumverf vir die Johannesburgse stadsraad.

Daar is goed gevorder met die standaardspesifikasies vir verf.

Twee belangrike spesifikasies, nl. grondverf vir hout en aluminiumverf vorder goed en ook die werk i.v.m. 'n aantal ander spesifikasies skiet mooi op. Wat fisiese toetse betref, is die fisiese standaardtoetsmetodes vir verf nou amper klaar opgestel. Wanneer die gedrukte eksemplare van bovermelde spesifikasies beskikbaar word, sal verbruikers oor die hele land korrosie van staal kan teëgaan en finansiële verliese tot 'n minimum verminder deur van erkende metodes vir skoonmaak en van prima korrosievaste grondverf van duursame beskermende versoorde gebruik te maak. Daar is reeds 25 spesifikasies beskikbaar wat ongeveer 70 tipes en grade verfmateriaal, hoofsaaklik grondstowwe, dek.

In vergelyking met verlede jaar het die toetswerk heelwat toegeneem. In die loop van die jaar is in die geheel meer as 1,200 monsters ondersoek wat meer as 3,000 toetse vereis het. Net soos vroeër is heelwat werk vir die Krygsproduksiekantoor, die Unieraad vir Tenders en Leweransies, die S.A. Polisie, die S.A. Spoorwegadministrasie, munisipaliteite en fabrikante van verf en grondstowwe vir verf gedoen. Minstens 25 persent van die totale toetswerk is in verband met die opstel van verfspesifikasies gedoen. Die aanname-inspeksies vir die Krygsproduksiekantoor en vir Yskor het ongeveer met 20 persent toegeneem in vergelyking met die vorige jaar. So is daar gedurende die jaar altesame 15,000 gelling verf vrygestel omdat dit aan die betrokke spesifikasies voldoen het, en sodoende is 'n totale uitgawe van meer as £19,000 beskerm.

Die hoeveelheid kontroletoetswerk i.v.m. die merk-skema was min of meer konstant. Toestemming om die merk aan te bring is aan een fabrikant van natuurlike witselbypigment vir verf verleen. Een distemperfabrikant het takke in Port Elizabeth en Kaapstad geopen en sy nuwe permit dek tans ook die gebruik van die merk op produkte van daardie twee plekke.

Die Buro se verfblootstellingstasie in Pretoria met ongeveer 1,100 panele en in Durban met meer as 900 panele vereis voortdurend roetine-inspeksie om die inligtingsverslae wat die spesifikasiekomitees nodig het en waarom fabrikante vra, by te hou. Die aantal versoeke om versnelde verwerkingstoetse in die laboratorium, van die nywerheid en van ander afdelings van

Many tests were also done for other sections of the Bureau and included tests of insecticides, paints, solvents, foods, glue, rubber caps and oil filters.

### Paint

The following private specifications were prepared, namely, a specification for road marking paint for the Union Tender Board and Supplies Office, two specifications covering a primer and an enamel finishing paint for implements for a local manufacturer, and a specification for aluminium paint for the Johannesburg City Council.

Considerable progress was made in the field of standard specifications for paint.

Two important specifications, namely, primers for wood and aluminium paints have reached an advanced stage and work on a number of other specifications is progressing satisfactorily. As far as physical tests are concerned, the work of preparing standard physical test methods for paint has virtually been completed. When printed copies of the above-mentioned specifications become available, consumers throughout the country will be in a position to combat corrosion of steel and minimize financial losses by using recognized methods of cleaning and quality anti-corrosive primers of durable protective paints. There are already 25 specifications available which cover about 70 types and grades of paint materials, mostly raw materials.

There has been an appreciable increase in test work compared with that of the previous year. During the course of the year a total of more than 1,200 samples were tested which resulted in over 3,000 tests being conducted.

As in previous years an appreciable amount of work was done for the Defence Production Office, Union Tender Board and Supplies Office, South African Police, South African Railways Administration, municipalities and manufacturers of paint and paint raw materials. At least 25 per cent of the total testing activity was done in relation to the preparation of paint specifications. There was an increase of about 20 per cent in the acceptance inspection done for the Defence Production Office and for I.S.C.O.R. compared to the previous period. Thus, during the year a total of 15,000 gallons of paint was released as complying with the relevant specifications and thereby safeguarding a total expenditure of more than £19,000.

Control testing in connection with the mark scheme was more or less constant in volume. One manufacturer of natural whiting extender for paints was granted the mark. One manufacturer of distemper extended his production to Port Elizabeth and Cape Town and his new permit now includes the use of the mark on the products from these centres.

The Bureau's paint exposure stations, one in Pretoria, with approximately 1,100 panels and one in Durban, with over 900 panels require constant routine inspection to



die Buro ontvang, het die aankoop van 'n vierde ultra-violet-dubbelboogligteenheid vir versnelde verbleik- en verweertoetse nodig gemaak.

### **Bitumens**

Hierdie Onderafdeling het 'n groot spesifikasieprogram, dog sy werk was hoofsaaklik beperk tot isoleermassas vir elektriese verbindings, asfaltmastiek, en hersiening van die spesifikasies vir bituminese padbindmiddels. Laboratoriumtoetse is ook vir die voorgestelde spesifikasies vir voegdigtingsmiddels vir waterhoudende konstruksies en vir pypbekledingsmiddels uitgevoer.

Die kontrolering van produkte wat die merk dra, het 'n groot persentasie van die onderafdeling se tyd in beslag geneem. Dit het dakvilt, vogdigte materiaal, asfaltmastiek, kreosoot en batterydigtingsmiddel gedek. Hierdie soort werk het toegeneem as gevolg van die publikasie van spesifikasies vir kreosote en kreosootmengsels vir houtverduursaming en het tot die uitreiking van permitte aan twee fabrikante van daardie produkte gelei.

Versoeke om die uitvoering van toetse het 'n opwaartse neiging getoon en was grotendeels verantwoordelik vir die toename van 13 persent in die aantal uitgereikte verslae. Hierdie werk het o.a. bestaan uit 'n reeks toetse op dakmateriaal, vloerteëls en bituminese samestellings en oplossings, en binne- en buitebekledings van pype. Toetse om ondersoekmetodes uit te werk is in samewerking met Yskor uitgevoer, en asfaltsamestellings is getoets in samewerking met fabrikante wat ingevolge die merkskema produseer.

### **Tekstiel en Klerasie**

Die hoeveelheid werk hierdie jaar deur die Afdeling Tekstiel en Klerasie behartig, het aansienlik toegeneem in vergelyking met die daaraan voorafgaande jare. Bewys hiervan is die instelling van drie nuwe onderafdelings om die uitbreiding die hoof te bied.

Die Afdeling is nou ingedeel in die volgende sewe onderafdelings: die Tekstielinspektoraat, Vesels, Garings en Gebreide Goedere, Weefstowwe, Kleurstowwe, Klerasie en Tekstielspesifikasies.

Die aantal besendings stukgoedere, komberse en bedspreie wat vir staatsdepartemente, die provinsiale administrasies, die S.A. Spoorwegadministrasie, en die Kamer van Mynwese geïnspekteer en getoets is, het tot 732 gestyg, d.w.s. 54 persent meer as tydens die daaraan voorafgaande ooreenstemmende tydperk. Groot hoeveelhede houers vir bewysboekies is ten behoeve van die Departement van Naturellesake geïnspekteer. Pette en petoortrekke deur 'n plaaslike firma vir Kenia en Tanganjika gemaak, is op groot skaal vir die Kroon-agente vir die Kolonies, Londen, gekeur.

build up the records of information required by specification committees as well as those requested by manufacturers. The volume of requests for laboratory accelerated weathering testing both from industry and from other sections in the Bureau necessitated the purchase of a fourth twin-arc ultra-violet light unit for accelerated fading and weathering tests.

### **Bitumens**

This Section has an extensive specification programme but work was confined mainly to electrical joint filling compounds, mastic asphalts, and revision of the specifications for bituminous road binders. Laboratory tests were also done for the specification projects for jointing compounds for water retaining structures and pipe coating compounds.

The control testing of products bearing the mark occupied a large percentage of the Section's testing capacity. These covered roofing felts, damp-proof materials, mastic asphalts, creosotes and battery sealing compound. This work has been increased by the publication of specifications for creosotes and creosote mixture for wood preservation resulting in the granting of permits to two producers of these commodities.

Requests for test work showed an upward trend and largely accounted for the increase of 13 per cent in the number of reports issued. This work included a series of tests on roofing materials, floor tiles and bituminous compounds and solutions, pipe linings and coatings. Tests for developing test techniques were done in collaboration with Iscor and also on asphaltic compounds in conjunction with manufacturers producing under the mark scheme.

### **Textiles and Clothing**

The volume of work dealt with by the Textile and Clothing Sections showed a very considerable increase on previous years. This is reflected by the establishment of three new sections to deal with the expansion.

The seven sections into which the Division is now sub-divided are: Textile Inspectorate, Fibres, Yarns and Knitwear, Fabrics, Dyes and Finishes, Clothing and Textile Specifications.

The number of consignments of piece-goods, blankets and bedspreads inspected and tested for government departments, the provincial administrations, the South African Railways Administration and the Chamber of Mines increased to 732, which is 54 per cent more than in the previous corresponding period. Large quantities of reference book containers were inspected on behalf of the Department of Native Affairs. Inspections of caps and cap covers manufactured by a local firm for Kenya and Tanganyika were carried out on a large scale for the Crown Agents for the Colonies, London.

Die aantal ontledings vir die Departement van Doeane en Aksyns het met 32 persent toegeneem tot 943 monsters van tekstielstukgoedere en -artikels. Hierdie toetse word al hoe ingewikkelder en tydwonder weens die steeds toenemende gebruik van kunsvesels, veral in allerlei soorte mengsels.

Met die aanstelling van 'n derde tekstielinspekteur kragtens die Handelswaremerkewet, met sy standplaas in Durban, het die aantal monsters wat geneem is om die aanduiding van die wolgehalte op tekstielgoedere na te gaan, en wat na die Buro gestuur is vir ontleding tot 203 aangegroei wat 50 persent meer is as verlede jaar.

Die aantal private spesifikasies vir staatsdepartemente en ander grootskaalse aankopers het 37 beloop gedurende hierdie tydperk, d.w.s. 'n toename van 76 persent. Onder hulle was daar 'n spesifikasie vir die knip, maak en afwerking van magistraatstogas vir die Departement van Justisie, vir sokkies, kouse en handskoene vir die Krygsproduksiekantoor, popelien-hemdemateriaal vir die S.A. Polisie, filter- en kaasdoek vir Yskor, en 'n groot verskeidenheid ander stukgoedere. Die aantal private spesifikasies deur die Afdeling Tekstiel en Klerasie opgestel, bedra tans 147.

Die werk i.v.m. standaardspesifikasies het ook goed gevorder en vier—vir denim, kamgaringsweepkoord, wolstof vir jasse en tweed—is gedurende die onderhawige tydperk voltooi. Nog 'n aantal aansoeke om toestemming vir die aanbring van die Buro se merk is ontvang en gunstig deur die Raad oorweeg.

Daar is nog steeds spesiale ondersoeke vir die Speurdiens van die S.A. Polisie uitgevoer.

Vanweë die ongeëwenaarde toename in die versoeke om hulp deur die Afdeling Tekstiel en Klerasie ontvang, was dit onvermydelik dat die toetswerk vir plaaslike fabrikante, handelaars en invoerders 'n geringe vermindering sou toon; nogtans het die aantal verslae vir private opdraggewers gedurende die onderhawige tydperk 278 beloop.

## DEPARTEMENT BIOLOGIESE WETENSAPPE EN MATERIALE

Die hoof van die Departement het 'n besoek aan die buiteland gebring om hom op hoogte te stel van standaardisering, wetgewing, kontrole en metodologie aldaar in swang met betrekking tot ingemaakte vrugte, snelbevore produkte, voorverpakte voedselprodukte, insektmiddels, farmaseutiese produkte en hul keuring en monsterneming. Op sy reisplan was daar ook besoeke aan mikrobiologiese en polisielaboratoria. Tydens hierdie reis is die grondslag gelê vir hartlike en nuttige samewerking met die 10 lande wat besoek is.

Onder die interessante kenmerke van die jaar was daar eerstens die vinnige groei van 'n nywerheid wat iets betreklik nuuts vir die Unie was, naamlik die snel-

The number of analyses for the Department of Customs and Excise increased by 32 per cent to 943 samples of textile piece-goods and articles. These tests are becoming more and more involved and time-consuming owing to the ever-increasing use of man-made fibres, particularly in all kinds of blends.

With the appointment of a third textile inspector under the Merchandise Marks Act, resident in Durban, the number of samples taken in respect of the wool contents marking of textile goods and submitted to the Bureau for analysis, increased to 203 which is 50 per cent higher compared with last year.

The number of private specifications prepared for government departments and other large-scale buyers was 37 in this period, or an increase of 76 per cent. These included a specification for the cut, make and trim of Magistrate's gowns for the Department of Justice, for socks, stockings and gloves for the Defence Production Office, poplin shirting for the Police, filter and mutton cloth for Iscor, and a great variety of other piece-goods. The number of private specifications prepared by the Textile and Clothing Sections now total 147.

Work on standard specifications also made good progress, and four—for denim, worsted whipcord, woollen overcoating, and tweed—were completed during the period under review. A number of further applications for the use of the Bureau's mark were received and approved by Council.

Special investigations continued to be carried out for the Criminal Investigations Department of the South African Police.

In view of the unprecedented increase in the demands on the services of the Textile and Clothing Sections it was inevitable that the test work carried out for local manufacturers, merchants and importers should show a slight decrease; nevertheless, the number of reports issued to private sponsors amounted to 278 during the period reviewed.

## BIOLOGICAL SCIENCES AND MATERIALS DEPARTMENT

An overseas visit was paid by the head of the Department to investigate and study standardization, legislation, control and methodology in their relation to canned foods, quick frozen products, pre-packaged food products, insecticides, pharmaceutical products and their inspection and sampling. Microbiological laboratories and police laboratories were also included in his itinerary.

Cordial and useful liaison was established in the ten countries visited.

Among the interesting features of the year were the rapid growth of an industry fairly new to the Union, namely, quick freezing of foodstuffs of which the consumer has been very quick to take advantage, and the

bevriësing van voedsel, en verbruikers het nie getalm om dit te benut nie; en tweedens die rasse skrede waarmee die farmaseutiese nywerheid voortuigegaan het, veral op die gebied van etiese preparate. Dit het gepaard gegaan met 'n merkbare verhoging van die belangstelling deur die nywerheid en die mediese professie in die Buro se spesifikasies en die toetsfasiliteite wat hy bied, aan die dag gelê.

Nog 'n bemoedigende kenmerk was die lewendige belangstelling deur die voedsel- en dranknywerheid in higiënemaatreëls vir fabriëke getoon, en die gebruik wat tans gemaak word van die fabriëksopnamediens deur die afdelings Mikrobiologie en Mikologie ingestel om die fabriëkant in hierdie opsig tot hulp te wees.

### Entomologie

Die werk i.v.m. röntgenondersoek van graan en ander saad in pakhuisse om die mate van insektebeskadiging tydens opslag te bepaal, het toegeneem. Die behoefte aan hierdie soort toetswerk word steeds groter. Ander eienskappe van saad, soos die kiemkrag, kan in sekere gevalle ook op hierdie manier bepaal word. Werk i.v.m. laasgenoemde projek sal in samewerking met die Saad-inspeksiediens van die Departement van Landbou gedoen word.

Openbare belangstelling in die motbestandmaking van woltekstielgoedere skyn toe te neem en baie versoëke om inligting i.v.m. hierdie onderwerp is ontvang. Baie toetse is op behandelde materiaalmonsters uitgevoer om te bepaal hoe maklik hulle deur kleremotlarwes aangetas word en ook om die duursaamheid van die motbestandmaking te bepaal. Hierdie werk is vir verskillende staatsdepartemente en woltekstiefabriëkante gedoen.

Die metodes in die Buro se spesifikasie vir wolklere voorgeskryf vir die teel van kleremotlarwes om as toetsinsekte te gebruik, is hersien om hulle in ooreenstemming te bring met die metodes deur die Internasionale Tekstielorganisasie beskryf.

Termietbestandheidstoetse is vir oorsese fabriëkante op behandelde en onbehandelde elektriese kables met polivinielchloriedisolering en poliëtileen- en pentateenwaterpype uitgevoer. Die Buro is ook versoek om inligting te verstrek in verband met die standaardisering van die termietbestandheidstoetse wat op die oomblik deur die Internasionale Standaardiseringsorganisasie oorweeg word.

Toetse is op boumateriaal en sintetiese vloerbedekkings gedoen om te bepaal of rotte dwarsdeur die monsters kon knaag of hul net kon beskadig. Roetinekontroletoetse op insektmiddels ingevolge die standaardmerkskema vervaardig en op insektmiddels wat plaaslik en oorsese geproduseer is, het heelwat van die Onderafdeling se tyd in beslag geneem.

Die gebruikskode vir die veilige gebruik van huishoudelike insektmiddels en die klassifisering van plaagbestrydingsmiddels (volgens hul giftige eienskappe en die gevaar

increasing development of the pharmaceutical industry, particularly in the field of ethical preparations. This has been accompanied by a noticeable broadening in the interests shown by industry and the medical profession in the Bureau's specifications and in the testing facilities it has to offer.

A further heartening feature was the keen interest shown by the food and beverage industry in plant hygiene measures, and the use now being made of the plant survey service, established by the Microbiological and Mycological Sections to assist the manufacturer in this field.

### Entomology

More work was done on the X-raying of stored grain and other seeds in order to determine the extent of insect damage while in storage. The need for this test work is becoming ever greater. Other characteristics of seeds, such as its powers of germination can, in certain cases also be determined by this method. Work on this latter project will be done in collaboration with the Seed Inspection Service of the Department of Agriculture.

Public interest in the moth-proofing of wool textiles appears to be on the increase and many requests for information on this subject were received. Many tests were conducted on treated samples of materials to determine their susceptibility to the larvae of the clothes moth and also to determine the durability of the moth-proofing treatment. The work was carried out for various government departments and wool textile manufacturers.

The methods of breeding clothes moth larvae for test insects as laid down in the Bureau's specifications for woollen clothing, were revised so that they could be brought into line with the methods described by the International Textile Organization.

Termite resistance tests were carried out for overseas manufacturers on treated and untreated polyvinyl chloride electric cables and polyethylene and pentathene water pipes. The Bureau was also requested to furnish information in connection with the standardization of the termite resistance methods at present under consideration by the International Organization for Standardization.

Tests were performed on building materials and synthetic floor coverings to determine whether the samples could be penetrated by rats or superficially damaged by them. Routine control testing on insecticides manufactured under the standardization mark scheme and on insecticides manufactured locally and overseas occupied a considerable portion of the Section's time.

The code of practice for the safe use of household insecticides, and the classification of pesticides (according to their poisonous properties and hazards in handling) were almost completed. The Bureau is also co-operating



wat hulle by hantering oplewer) is voltooi. Die Buro werk ook saam met die British Standards Institution en die Internasionale Standaardiseringsorganisasie by die opstel van 'n lys gebruiklike name vir plaagbestrydingschemikalieë.

#### **Voedsel, Voer en Voedselinspeksie**

Die gebied deur die Afdeling Voedsel, Voer en Voedselinspeksie gedek het gedurende die jaar aanmerklik uitgebrei. Die standaardspesifikasies vir varkvoer, ingemaakte stokvis en snelbevore vis is voltooi, terwyl voortgegaan is met dié vir beesvoer, witvismeele, gedroogde wei en babakos, vismeel en mineraalmengsels vir plaasdiere. 'n Begin is gemaak met die werk in verband met die opstel van standaardspesifikasies vir snelbevore vrugte en groentes en vir vleis in deursigtige verpakings. Verder is die hersiening van die standaardspesifikasies vir ingemaakte vrugte- en groentesoorte voltooi en is begin met die werk in verband met uitbreiding van laasgenoemde spesifikasie om ook tamatie- en pimentkonsentraat te omvat. Die Afdeling het die taak op hom geneem om 'n private spesifikasie op te stel vir vismeel vir gebruik om voedsel te verryk.

Toestemming om die merk op sy pluimveevoer aan te bring, is aan 'n maatskappy verleen wat drie voerfabrieke beheer, waardeur die totale aantal fabrieke wat hierdie voersoorte kragtens die merkskema vervaardig, op 28 te staan kom. Toestemming om die merk op hul produk aan te bring, is ook aan nog twee roomysfabrikante verleen.

Gedurende dié jaar het nog 'n vrugte-inmaker produksie ingevolge die merkskema begin, wat die totale aantal vrugte-inmaakfabrieke wat ingevolge die skema produseer, tot ses opgevoer het. 'n Derde fabriek is gemagtig om ingemaakte vleis wat aan die standaardspesifikasie vir hierdie artikel voldoen, te produseer. Die vleisprodukte, vrugte en groentes volgens die merkemastandaard ingemaak, was 'n duidelike bewys van die feit dat die SABS-ellips met die ruit op hierdie produkte teenswoordig by die verbruikers visioene van uitstekende gehalte en eenvormigheid van produksie oproep. Ook is aansoek vir die vervaardiging, ingevolge die merkskema, van pynappelsap en ingemaakte tamatiekonsentraat ontvang. Albei hierdie aansoeke was suksesvol. 'n Internasionale maatskappy met vier fabrieke wat die hele Unie voorsien, het ook met sukses aansoek gedoen om toestemming om sy bruisdranke ingevolge die merkskema te bemark.

Die keuring van produkte gedek deur die verpligte standarde vir ingemaakte vis, ingemaakte kreef en ingemaakte vleisprodukte, met inbegrip van dieselfde soort ingevoerde produkte, is voortgesit. Net soos in die afgelope paar jaar het die goeie kwaliteit en klein aantal afkeurings, duidelik getoon met hoeveel sorg fabrikante te werk gaan om te verseker dat hul ingemaakte voedsel veilig en smaaklik is.

with the British Standards Institution and the International Organization for Standardization in drawing up a list of common names for pest control chemicals.

#### **Foods, Feeds and Food Inspection**

The field covered by the Foods, Feeds and Food Inspection Division expanded notably during the year. The standard specifications for pig feeds, canned hake and quick-frozen fish were completed, while work continued on those for cattle feeds, white fish meal, dried whey and baby foods, fish meal and mineral supplements for farm animals. Work on the preparation of standard specifications for quick-frozen fruit and vegetables and for open-pack meats was commenced. In addition, the revision of the standard specifications for canned fruits and vegetables was completed and work on the extension of the latter specification to cover tomato and pimento concentrate was begun. The Division assumed the responsibility for the preparation of a private specification for fish flour to be used for food enrichment.

Permission to apply the mark to its poultry feeds was granted to a company operating three feed mills, bringing the total number of factories producing these feeds under the mark scheme to 28. Two further manufacturers of ice cream were granted permission to use the mark on their products.

During the year a further fruit canner commenced production under the mark scheme bringing the total number of canned fruit factories operating under the scheme to six. A third factory was authorized to produce canned meats complying with the standard specification for this commodity. The canned meat products and canned fruit and vegetables manufactured under the mark scheme standards clearly revealed the excellence and uniformity of production that consumers have come to associate with the S.A.B.S. diamond ellipse on these products. Applications for the production, under the mark, of pineapple juice and canned tomato concentrate were also received. Both these applications were successful. An international company with four factories and Union-wide coverage also applied successfully to market its mineral waters under the mark scheme.

The inspection of products covered by the compulsory standards for canned fish, canned rock lobster and canned meat products, including imported products under these headings, continued. As in previous years the high quality and small number of failures noted, demonstrated the care taken by manufacturers to ensure safe and palatable canned foods.

The inspection of quick-frozen fish manufactured to the standard specification was commenced. When this specification—the first of its kind in South Africa—was completed during the year under review, the only

'n Aanvang is gemaak met die keuring van snelbevrose vis volgens die standaardspesifikasie geproduseer. Toe hierdie spesifikasie—die eerste in sy soort in Suid-Afrika—gedurende die jaar voltooi is, het die enigste fabrikant van snelbevrose vis in die land onmiddellik aansoek gedoen om toestemming vir die aanbring van die merk op sy produk, en dit gekry, wat nog 'n belangrike stap vorentoe vir die Suid-Afrikaanse nywerheid beteken.

'n Baie groot verskeidenheid monsters is vir munisipaliteite, staatsdepartemente, nyweraars en mynmaatskappye ontleed en ook is analises uitgevoer in verband met die toepassing van spesifikasies. 'n Opmerkswaardige feit was die groot aantal moutmonsters wat vir bepaling van hul diastatiese vermoë ingestuur is. Omdat daar nie in geslaag is om 'n goedkoop, vinnige metode vir die bepaling van die biologiese waarde van proteïene wat onder andere in die vismeelspesifikasie gebruik moet word, te verkry nie, is besluit om die proteïenverteerbaarheid van 'n groot aantal monsters vismeel te bepaal.

Die Afdeling was verteenwoordig in 'n komitee van die Departement van Landbou wat aangestel is om die ontledingsmetodes vir voersoorte te standaardiseer, en 'n aansienlike aantal ontledings is in hierdie verband gedoen. 'n Begin is ook gemaak met die werk in verband met 'n ondersoek deur die Suiwelafdeling van die Landboudepartement met betrekking tot die noukeurigheid van die Gerbermetode vir die toets van die vetgehalte van melk. Die Afdeling se aandeel in hierdie werk het bestaan in die gereelde ondersoek van monsters melk oor 'n tydperk van vier maande, waarby van twee gevestigde metodes gebruik gemaak is.

### **Mikrobiologie**

Gedurende die onderhawige tydperk het fabriek in die Unie en Suidwes-Afrika 5,000 ton ingemaakte vleis en 55,850 ton ingemaakte vis geproduseer. By toepassing van die verpligte spesifikasies is 39,355 monsterblikkies vleis uit 6,796 produksies ondersoek; slegs 'n geringe aantal hiervan het nie aan die vereistes voldoen nie. Ook is 57,071 monsterblikkies vis uit 4,720 produksies afkomstig ondersoek. Ook in hierdie geval was die persentasie nie-voldoenings baie laag.

In samewerking met die Afdeling Mikologie is 'n nuwe diens vir die nywerheid ingestel, in die vorm van opnames van die lynproduksie van bruisdrankfabriek, wat die fabrikant in staat stel om die presiese bronne van mikrobiologiese besoedeling van sy produk vas te stel en dan voorkomingsmaatreëls te tref.

Monsters van verskillende produkte soos bv. ingemaakte vrugte en groentesoorte, konfynt, gelatien, roomys en ontsmettingsmiddels ingevolge die standaardmerkskema geproduseer, is met gereelde tussenpose ondersoek om te bepaal of die standaard gehandhaaf bly.

'n Hoogtepunt in die jaar is bereik met die uitgawe van 'n gebruikskode vir voedselhigiëne wat die higiëniese vereistes dek vir die bewerking, hantering, vervaardiging

manufacturer of quick-frozen fish in the country immediately applied for and obtained permission to use the mark on his product, thus marking a further important step in the progress of South African industry.

A very wide range of samples was analysed for municipalities, government departments, industrialists and mining companies in addition to analyses conducted in connection with the administration of specifications. A noteworthy feature was the large number of malt samples submitted for determination of diastatic power. In view of the failure to obtain a rapid and inexpensive method of determining the biological value of proteins to be used, *inter alia*, in the fish meal specification, it was decided to ascertain the protein digestibility of a large number of fish meal samples.

The Division was represented on a committee of the Department of Agriculture appointed to standardize analytical procedure in respect of feedstuffs, and a considerable number of analyses were carried out in this connection. Work relating to an investigation by the Division of Dairying of the Department of Agriculture concerning the accuracy of the Gerber method of testing for the fat content of milk was also commenced. The Division's share of this work consisted of the regular testing of milk samples over a period of four months, employing two established methods.

### **Microbiology**

During the period under review, factories in the Union and South West Africa produced 5,000 tons of canned meat and 55,850 tons of canned fish. Under the administration of the compulsory specifications 39,355 sample cans of meat from 6,796 productions were examined, only a small number being found not to comply with the requirements. Similarly, 57,071 sample cans of fish from 4,720 productions were examined. Of these, too, the percentage of non-compliance was very low.

In conjunction with the Mycology Section a new service to industry was started, consisting of mineral water plant production line surveys, by which means the manufacturer can pinpoint the sources of the microbiological contamination of his product, and thus take preventive measures.

Samples of various substances such as canned fruit and vegetables, jams, gelatine, ice cream and disinfectants produced under the standardization mark scheme were examined at regular intervals for maintenance of standards.

A highlight of the year was the publication of a code of practice for food hygiene covering the hygienic requirements for the processing, handling, manufacture

en bewaring van voedsel, asook die vereistes vir verseringsondernemings. Die kode wat groot belangstelling in verbruikers- en hotelhouderskringe verwek het, kan indien toegepas, tot baie besliste verbeterings in die metodes vir die hantering en verduursaming van voedselware lei en help om die aantal siektegevalle aan „voedselvergiftiging” toegeskryf, te verminder. Met die oog op die moontlike formulering van spesifikasies, is verskillende ondersoeke in verband met kwaterenêre ammoniumverbindings, gesteriliseerde melk en room, snelbevore vis, vismeel, deursigtige visverpakkings en fenoliese antiseptika onderneem.

Voorsiening is gemaak vir die basiese vereistes vir bakteriologiese werk, nie alleen vir die Afdeling self nie, maar ook vir die Afdelings Mikologie, Vitamiene en Farmaseutiese Produkte, deur die bereiding van meer as 2,100 liter voedingsmedium en deur 'n versameling onontbeerlike bakteriestamme in stand te hou. Verskillende buitestaande inrigtings het gebruik van hierdie nuttige diens gemaak.

### Mikologie

Bruisdranke is gereeld getoets om te bepaal of hulle aan die mikologiese vereistes in die spesifikasie vir hierdie produkte voorgeskryf, voldoen.

Monsters verf wat swamkerende bestanddele bevat, is aan toetse onderwerp om te bepaal in watter mate die ingeslote swamdoders doeltreffend is. Dit is 'n nuwe ontwikkeling in Suid-Afrika en is veral van belang in kusgebiede en in voedsel-fabriek en ander fabriek waar in stoom gebruik word.

Die probleem van die te vroeë onbruikbaarwording van borsels wat vir die skoonmaak van lemoene vir uitvoerverpakking gebruik word, is vir die Koöperatiewe Sitrusbeurs Bpk. ondersoek. By hierdie ondersoek het geblyk dat die oorsaak van die onbruikbaarwording 'n swam was wat tot nog toe nog nêrens in die bestaande literatuur beskryf is nie. Dit is 'n waardevolle ontdekking waardeur hierdie organisme as 'n toetsswam gebruik kan word vir die bepaling van hetsy die natuurlike, hetsy die kunsmatige sterkte van verskillende soorte borselhare. Die swam behoort tot die genus *Aleurisma* en is nou verwant aan die meeste fungi wat die mens aantast, soos bv. dié organismes wat voetskimmel en ringwurm veroorsaak.

Howardskimmeltellings is gereeld gedoen op tamatiepasta deur verskillende fabrikante geproduseer. Mikologiese toetse is op ingemaakte vrugte uitgevoer om te bepaal of hulle vry van giste en skimmels was. Verskillende soorte graansakke is getoets om die bestandheid van die verskillende vesels teen swamaantasting te bepaal, en toetse is op monsters hout wat met 'n swamwerende preparaat behandel was, uitgevoer om die doeltreffendheid van die behandeling te bepaal.

Gereelde toetse is gedoen om bestandheid teen swamaantasting te toets van monsters katoenseildoek wat deur verskillende fabrikante behandel is.

and storage of food, as well as requirements for catering establishments. The code, which aroused great interest in consumer and hotelier circles can, if implemented, lead to very definite improvements in methods of handling and conserving foodstuffs, and help to reduce the number of illnesses ascribed to “food poisoning”. With a view to the possible formulation of specifications, various investigations relating to quaternary ammonium compounds, sterilized milk and cream, quick-frozen fruit and vegetables, frozen fish, fish meal, open-pack meats and phenolic antiseptics were undertaken.

Provision was made for the basic requirements of bacteriological work, not only for the Section's own needs but also for the Mycology, Vitamins and Pharmaceuticals Section, by the production of more than 2,100 litres of culture media and by the maintenance of a stock culture collection of essential bacterial strains. Various outside institutions benefited by the useful service this collection provides.

### Mycology

Mineral waters were regularly tested to determine their compliance with the mycological requirements laid down in the specification for these products.

Paint samples containing anti-fungal ingredients were subjected to tests for the determination of the effectiveness of the incorporated fungicides. This is a new development in South Africa and is especially important in coastal areas, in food factories and other factories where steam is used.

The problem of the premature failure of brushes used in cleaning oranges for export packing was investigated for the South African Co-operative Citrus Exchange Ltd. On investigation by the Section it was found that the cause of the failure was a fungus not hitherto described in the literature. This is a valuable discovery in that this organism can be used as a test fungus for the determination of either natural or induced resistance of various brush bristles. The fungus belongs to the genus *Aleurisma* and is closely related to most of the human fungal pathogens such as the organisms causing athlete's foot and ringworm.

Howard mould counts were regularly carried out on tomato paste produced by various manufacturers. Canned fruits were subjected to mycological tests to determine their freedom from yeasts and moulds. Different types of grain bags were tested to determine the fungal resistance of the different fibres, and tests were conducted on samples of timber treated with an anti-fungal preparation to determine the effectiveness of the treatment.

Regular tests to determine resistance to fungal attack were performed on samples of cotton duck treated by various manufacturers.



Die Buro se swamversameling is nog gereeld getoets om hul nut by laboratoriumbepalings as aantasters van wol, katoen en leer te bepaal.

Die Gebruikskode vir die Voorkoming van Agteruitgang te wyte aan Tropiese Toestande wat enige jare gelede uitgegee is, dien nog steeds as 'n waardevolle gids vir persone wat in tropiese en sub-tropiese klimaat woon of handel dryf.

#### Farmaseutiese Produkte

Daar was 'n opvallende toename in die gebruikmaking van die Afdeling se fasiliteite deur fabrikante van farmaseutiese produkte. In die meeste gevalle is die toetse wat aangevra is, uitgevoer met die doel om fabrikante in staat te stel om strengere kwaliteitskontrole uit te oefen, en ook om die bewys te lewer dat hulle produkte aan die wettereguleringe vereistes wat vitamiengehalte betref, voldoen. Om in die behoeftes van die nywerheid te voorsien, moet hierdie toetse binne 48 uur na ontvangs van die monster voltooi word. In die geheel is 163 verslae van hierdie aard deur die Afdeling ingedien.

Ingevolge die aanname-inspeksieskema is sowat 90 besiddings farmaseutiese preparate geïnspekteer en monsters daaruit geneem wat getoets is en waaromtrent verslag gedoen is aan die Unieraad vir Tenders en Leweransies.

Daar is besluit om die spesifikasies vir dekstrose en dekstrose-plus-natriumchloried vir inspuiting, natriumchloried, samegestelde oplossings van natriumchloried en natriumlaktaat vir parenterale gebruike opnuut te redigeer en in die vorm van los blaadjies te publiseer. Die betrokke toetsmetodes word afsonderlik gepubliseer, ook in die vorm van los blaadjies, onder die titel S.A.B.S.-standaardtoetsmetodes.

'n Begin is gemaak met spesifikasies vir A.C.D.-oplossings en Darrow se oplossing.

Kontroletoeswerk is gedoen op insulien, protamien-sinkinsulien en pirogeenvrye water vir inspuiting ingevolge die merkskema geproduseer.

Aan een fabrikant van dekstrose, natriumchloried en dekstrose en natriumchloried vir inspuiting is toestemming verleen om die merk op sy produkte aan te bring.

Ten einde aan die toenemende vraag om roetine-toetse en ander bepalings te voldoen, is 'n spektrometer met fluometriese hulpstukke, en 'n polarimeter waarmee baie noukeurig gemeet kan word, aangeskaf.

Dit stem tot dankbaarheid dat gemeld kan word dat dit moontlik geword het om 'n paar van die vakante poste in die onderafdeling te vul, en dat die groter hoeveelheid werk sodoende op bevredigende wyse afgehandel kon word.

#### Vitaminologie

Hierdie onderafdeling het hom besig gehou met die bepaling van vitamien van die B-groep, met inbegrip van tiamien (B<sub>1</sub>), riboflavin (B<sub>2</sub>), piridoksien (B<sub>6</sub>),

Testing of the Bureau's collection of fungi to determine their usefulness in laboratory determinations as attackers of wool, cotton and leather continued.

The Code of Practice for Preventing Tropical Deterioration which was published some time ago continues to provide a useful guide for all living and trading in tropical and subtropical climates.

#### Pharmaceuticals

Increasing use by manufacturers of pharmaceutical products of the Section's facilities was made with the object of enabling them to effect stricter quality control, and also to provide proof that their products complied with the legal requirements in respect of vitamin content. To meet the needs of industry these tests have to be completed within 48 hours of receipt of the sample. A total of 163 reports of this nature was issued by the Section.

Under the acceptance inspection scheme some 90 consignments of pharmaceutical preparations were inspected, sampled, tested and reported on for the Union Tender Board and Supplies Office.

It was decided to re-edit the specifications for dextrose and dextrose sodium chloride injections, sodium chloride, compound sodium chloride and compound sodium lactate solutions for parenteral administration and to publish them in loose-leaf form. The relevant test methods are being published separately, also in loose-leaf form as S.A.B.S. Standard Test Methods.

Work was commenced on specifications for Darrow's and A.C.D. solutions.

Control testing was carried out on the insulin, protamine zinc insulin and pyrogen-free water for injection manufactured under the mark scheme.

A manufacturer of dextrose, sodium chloride and dextrose and sodium chloride injection successfully applied for the use of the mark on his products.

In order to satisfy the growing demand for routine tests and other determinations a spectrophotometer with fluorometric attachments and polarimeter with a high degree of accuracy were purchased.

It is gratifying to be able to report that it became possible to fill some of the vacant posts in the Section and that, as a consequence, its expanding activities could be dealt with satisfactorily.

#### Vitaminology

The Section was occupied with the determination of vitamins of the B-group including thiamine (B<sub>1</sub>), riboflavin (B<sub>2</sub>), pyridoxine (B<sub>6</sub>), folic acid, nicotinamide and

foliensuur, nikotienamied en pantoteensuur, sowel as ander vitamieë soos inositol, cholien en biotien (vit. H). Al hierdie vitamieë word volgens gestandaardiseerde mikrobiologiese metodes bepaal.

Kontroletoesing van pluimveevoer, ingevolge die standaardmerkskema, vir hul pantoteensuur- en riboflaviengehalte het omtrent 75 persent van die onderafdeling se tyd in beslag geneem; die res van hul tyd is bestee aan werk vir private firmas en organisasies soos die Unieraad vir Tenders en Leweransies. Vir laasgenoemde liggaam is o.a. vitamieë in farmaseutiese preparate soos vitamienstropie, multivitamientablette en vitamin-B-kompleks vir inspuiting, bepaal.

Vitamietoetsing is op sekere heuningpreparate, kaffieroringmeel, melasse en gismonsters gedoen.

Nog 'n aspek van die werk was die mikrobiologiese bepaling van aminosure in voedsels; vir hierdie doel is verskillende voedsels en proteïenhidrolisate ontleed. 'n Nuwe afwyking met 'n sekere mate van belang was dat sowel vitamieë as die essensiële aminosure in monsters walvisvisleismeele bepaal is.

'n Bemoedigende teken was die aansienlik groter vraag om vitamienbepalings te doen. In die geval van sekere bepalinge het dit nodig geword om chemiese metodes in die plek te stel van die meer tydroende mikrobiologiese bepalinge wat vroeër gedoen is, om die diens sodoende te versnel.

#### DEPARTEMENT FISIKA EN ELEKTROTEGNIËSE INGENIEURSWESE

Landswye belangstelling in nie-verniëgende toetswerk was baie opvallend gedurende die verslagjaar, en om hierdie diens so vinnig en doeltreffend moontlik te lewer, is 'n takkantoor op Vereeniging geopen. Aangesien die meeste versoeke om hierdie soort toetswerk van die goudmyne en die swaar nywerhede kom, is die nuwe tak gerieflik geleë. Heelwat meer belangstelling in die vlamdigmakingsaspek van veiligheid in die myne is aan die dag gelê; die vraag om hierdie diens was so groot dat meer personeel aangestel moes word.

Nog 'n verblydende feit is dat die elektriese ingenieurswesenywerheid skynbaar al hoe meer bewus word van die waarde van standaarde, en in toenemende mate belangstel in gebruikskodes wat opgestel is vir die installering en werking van die gestandaardiseerde produk. Elektriese standaardisering is tot nog toe gedoen met die oog op toekomstige uitvoermarkte om die weg te baan vir maklike handeldrywing met die ander lande in Afrika.

pantothenic acid, as well as other vitamins such as inositol, choline and biotin (vit.H), these vitamins being determined according to standardized microbiological methods.

Under the standardization mark scheme, control testing of poultry feeds for their pantothenic acid and riboflavin contents took up about 75 per cent of the Section's time, the remainder being spent on work for private firms and organizations such as the Union Tender Board and Supplies Office. Tests for the latter body included the determination of vitamins in pharmaceutical preparations such as vitamin syrups, multivitamin tablets and vitamin B-complex injections.

Vitamin tests were carried out on certain honey preparations, kaffircorn meal, molasses and yeast samples.

A further aspect of the work done was the microbiological determinations of amino acids in foodstuffs, various foodstuffs and protein-hydrolysates being analysed for the purpose. A new departure of some interest was that vitamins as well as the essential amino acids were determined on samples of whale meat meal.

An encouraging feature was the considerably increased demand for vitamin determinations. In the case of certain determinations it became necessary to substitute chemical methods for the more time-consuming microbiological assays formerly performed in order to speed up the service.

#### PHYSICS AND ELECTRICAL ENGINEERING DEPARTMENT

Country-wide interest in non-destructive testing has become very marked during the year reviewed, and in order to provide this service as expeditiously and efficiently as possible, a branch office has been opened in Vereeniging. As the greater number of requests for this type of testing comes from the gold mines and from heavy industry, the new branch is conveniently situated. Considerably increased interest in the flameproofing aspect of mining safety has also become very noticeable, the demand for these services necessitating augmented staff for the Section.

A further development is the apparently growing realization in the electrical engineering industry of the value of standards, and the increasing interest taken in simultaneously prepared codes of practice to cover the installation or operation of the standardized product. The electrical standardization so far carried out has been done with an eye to future export markets and has conformed as far as possible with international requirements so as to leave the way open for easy trade with the other countries of Africa.

## AFDELING FISIKA

### Nie-vernietigende Toetswerk

Hierdie goedgevestigde Onderafdeling is voltyds besig gehou met sy dienslewering aan die nywerheid in die vorm van radiografiese, ultrasoniese en ander ondersoek van masjienonderdele en gefabriseerde konstruksies. En tog was die netto toename in die hoeveelheid werk vir die eerste keer sedert die instelling van hierdie Onderafdeling effens minder as in vorige jare. Dit is toe te skrywe aan die feit dat minstens twaalf groot nywerheidsorganisasies tans self hierdie soort werk doen, wat bewys hoe goed die Buro daarin geslaag het om die swaar nywerhede in Suid-Afrika van die belangrikheid van moderne toetsmetodes te oortuig.

Die neiging om tot die nie-vernietigende toetswerk oor te gaan, het ook geblyk uit die versoeke wat ontvang is om röntgenfotografie op te lei, veral in verband met die kwaliteit van sweiswerk. As gevolg hiervan is 'n kursus uitgewerk waarin praktiese sweisradiografie behandel sal word en wat aanstaande jaar gegee sal word; namate die noodsaaklikheid daarvoor ontstaan, sal hierdie kursus deur verdere kursusse gevolg word.

Veral opvallend was die land se klaarblyklike behoefte aan geskikte aannestandaarde wanneer van nie-vernietigende toetse gebruik gemaak word; dit was duideliker die geval by ultrasoniese toetse as by radiografie waar oorsese kodes en 'n private spesifikasie—vir pachuca-tenks vir die uraan-nywerheid—beskikbaar is. Hierdie aspek geniet aandag.

Die Durbanse tak van hierdie Onderafdeling het voortgegaan om uitstekende werk vir die skeepsreparasie-nywerheid en die suikermeule te doen. Dit is meldenswaardig dat 'n Deense ingenieur wat na Suid-Afrika gestuur is om toesig te hou by die reparasie van 'n skip, dit die moeite werd geag het om 'n reis na Pretoria te maak om die Onderafdeling Nie-vernietigende Toetswerk te raadpleeg in verband met die ondervinding wat hy met sekere soorte toerusting opgedoen het.

Om met die moderne ontwikkelings tred te hou, is besluit om 'n Tegnieuse Beampte na Europa en Engeland te stuur om 'n Lloyds-kursus in radiografie te volg. Dit stem tot tevredenheid om te kan meld dat die Buro op die gebied van radiografie in geen enkele opsig by Europa agterstaan nie wat betref die soort werk wat gedoen word. Dit word gestaaf deur die feit dat die Buro-beampte die beste punte behaal het in die eksamen wat na afloop van die kursus gehou is. Dit het egter geblyk dat daar in Europa baie meer gebruik van ultrasoniese toetse gemaak word as op die oomblik in Suid-Afrika, hoewel in 'n taamlik gespesialiseerde vorm wat geskik is vir groter hoeveelhede spesifieke soorte werk of produkte wat gewoonlik nie hier aangetref word nie.

Die normale reeks opdragte wat uitgevoer is, het gevarieër van die ondersoek van al die Sabre-vliegtuie van die S.A.L.M. tot die toets van brugkonstruksies vir

## PHYSICS DIVISION

### Non-destructive Testing

This well established Section was kept fully occupied by its services to industry in the form of radiographic, ultrasonic and other testing of machine parts and fabricated structures. Yet, for the first time since the establishment of the Section the nett increase in the volume of work was somewhat less than in previous years. This can be attributed to the fact that at least twelve large industrial organizations are now doing this type of work for themselves, which can be interpreted as a sign of the success the Bureau has achieved in bringing the importance of the modern testing methods home to South African heavy industry.

The trend towards non-destructive testing was also noticeable by the requests received for the training of radiographers, especially for welding quality. As a result, a course has been designed which will deal with practical welding radiography, and which will be held during the coming year, to be followed by further courses as the need indicates.

Particularly noticeable was the country's apparent need for suitable standards of acceptance when non-destructive tests are used, more markedly so in the case of ultrasonic tests than in radiography for which overseas codes and a private specification—for pachuca for the uranium industry—are available. This aspect is receiving attention.

The Durban branch of the Section continued to do sterling work for the shipping repair industry and the sugar mills. It is worthy of mention that a Danish engineer sent to South Africa to supervise repairs on a ship, considered a trip to Pretoria worthwhile in order to consult the Non-destructive Section on its experience with certain types of equipment.

To keep abreast of modern developments it was decided to send a Technical Officer to the Continent and to England where he attended a Lloyds course in radiography. It is gratifying to be able to report that in the field of radiography the Bureau is in no way behind Europe in the types of work handled. This can be substantiated by the fact that the Bureau officer headed the list in the examination held at the conclusion of the course. It was found, however, that ultrasonic tests find much wider application in Europe than at present in South Africa albeit in rather specialized forms suited to greater volumes of specific classes of work or of products not usually found locally.

The normal run of tasks accomplished ranged from tests on all the Sabres of the S.A.A.F. to testing bridge structures for the Rhodesias and a large oil storage tank in Lourenco Marques.

Noticeable too was the increased use of radiography to determine the exact position (apart from location) and size of reinforcing steel in concrete structures—a problem



die Rhodesië en 'n groot olieopgaarten in Lourenco Marques. Opvallend was ook die toename in die gebruik van radiografie om die presiese posisie (afgesien van die opsporing) en die grootte van wapeningstaal in betonbouwerke te bepaal—'n probleem waarvoor argitekte en bou-ingenieurs dikwels te staan kom by aanbouings aan ou geboue. Daar was 'n klein toename in die aantal röntgenplate wat van monsters graan geneem is as 'n middel om die beskadiging van voorrade in opslagplekke deur insekte te bestry—'n aspek waarop nog dieper ingegaan moet word.

#### **Ontploffingsgevaar**

Die instelling van hierdie onderafdeling verlede jaar is meer as geregverdig deur die toename in die werk wat gedoen is en die waarde wat deur die Staatsingenieur se Hoofinspekteur van Masjinerieë daaraan geheg word. Die werk bestaan in die ondersoek van verskillende soorte masjiene soos waaiers, motore, steenkoolsae, bore en plowers, om te bepaal of hulle geskik is om in gasryke myne of op ander gevaarlike plekke gebruik te word.

Die jaar is gekenmerk deur die groter nadruk wat op hierdie aspek van mynveiligheid gelê is deur die Departement van Mynwese, en deur die ooreenstemmende groter aantal versoeke om ondersoek wat ontvang is. Vermeerdering van die personeel het nodig geword om die Onderafdeling in staat te stel om by te bly met die werk en terselfdertyd besoeke af te lê en praatjies te lewer om gebruikers van die betrokke soort toerusting 'n beter begrip van die onderwerp te gee.

Aan drie fabrikante is toestemming verleen om die spesiale vlamdigtheidsmerk of die merk van wesenlike veiligheid op hul produkte aan te bring, waardeur die totale aantal van hierdie klas merkhouders op 5 te staan kom.

Vlamdigte en dergelike toerusting moet goed in orde gehou word, wil dit veilig bly vir gebruik, en dit word al hoe duideliker dat 'n geskikte gebruikskode gewens is waarin die punte wat vir onderhoudspersoneel die belangrikste is, uiteengesit word.

Daar is 'n begin gemaak met die werk in verband met die opstel van spesifikasies vir toerusting vir gebruik in toestande waar volkome vlamdigte uitrusting vervang kan word deur goedkoper maar tog veilige toestelle wat geskik is vir gebruik onder die bepaalde omstandighede. Die oprigting van 'n tydelike toetsstasie op 'n plek waar ploftoetse veilig uitgevoer kan word, het baie gehelp en inderdaad die werk moontlik gemaak, hoewel dit geensins die behoefte aan 'n spesiale permanente laboratorium, wat tans deur die Gebouekomitee oorweeg word, minder dringend gemaak het nie.

#### **Fotometrie**

Hierdie Onderafdeling waarop die taak rus om traakters vir padvoertuie te toets, buiten en behalwe hul werk in verband met verskillende soorte lampe en projektors, het wat eersgenoemde werk betref 'n baie

which often faces architects and structural engineers when extensions to old buildings are contemplated. There was some increase in the number of X-ray plates taken of grain samples as a means of controlling insect damage to stored stocks, an aspect to be further developed.

#### **Flameproof Section**

The establishment of this Section last year was more than justified by the increase in work handled and the importance attached to it by the Government Engineer's Chief Inspector of Machinery. The work concerns the testing of a variety of types of machines such as fans, motors, coal-cutters, drills and shot exploders, for suitability for use in fiery mines and other hazardous locations.

The year was characterized by the greater emphasis laid on this aspect of mining safety by the Department of Mines and by a correspondingly greater number of requests for tests to be made. An increase of staff was necessary to enable the Section to keep up to date with its work whilst at the same time undertaking visits and talks to promote better understanding of the subject amongst users of the type of equipment involved.

Three manufacturers were granted permission to use the special flameproof mark or intrinsically safe mark on their products thus bringing the total for this class of markholders to five.

Flameproof and similar equipment must be kept in a satisfactory state of repair if it is to remain safe for use and the need for a suitable code of practice outlining the points of particular importance for maintenance staffs has become progressively greater.

Work has started on the preparation of specifications for equipment for use in circumstances where fully flameproof gear can be replaced by less expensive but nevertheless safe equipment adequate for use under the required conditions.

The provision of a temporary test station in a position where explosion tests could safely be carried out was of great assistance and indeed made the work possible, although it by no means reduced the urgency for the special permanent laboratory now being considered by the Buildings Committee.

#### **Photometry**

This Section which carries the burden of testing retro-reflectors for road vehicles in addition to its work on lamps and projectors of various types, went through a most trying time in respect of the former activity. What

moeilike tyd deurgemaak. Wat verlede jaar 'n ontsaglike toename in die werk op hierdie gebied genoem is, versink in die niet in vergelyking met die hoogtes wat gedurende die laaste helfte van die verslagjaar bereik is. Dit strek die Onderafdeling tot eer dat hulle hul so goed van hul taak gekwyt het. Met belangstelling sal opgemerk word dat die grootste van die magdom verslae wat opgestel is, besonderhede van sowat 9,000 afesings bevat het.

Die aantal fabrikante wat toestemming gekry het om die merk op hul truikaatsers aan te bring, beloop tans ses, en altesaam het hulle meer as 32 miljoen weerkaatsereenhede vervaardig, waarvan party van beter kwaliteit is as die ingevoerde artikels wat tot nog toe ondersoek is. Onvoldoende weerstand teen korrosie aan die kus, het in party gevalle moeilikheid opgelewer, dog die strenger vereistes en toetse wat die afgelope jaar ingevoer is, behoort te verseker dat 'n artikel gemaak word wat korrosie goed kan weerstaan.

Soos verwag is, het die aantal truikaatsers vir ondersoek ontvang, afgeneem. Heelwat tegniese moeikhede is ondervind by die verandering van die Onderafdeling se bestaande toerusting om dit bruikbaar te maak vir die toetse deur die wysigings, in Desember 1957 ingevoer, vereis. Hierdie wysigings vereis nl. dat metings by 'n verskillende stel hoeke gedoen word—ooreenkomstig die gebruik in Brittanje en die V.S.A.—wat weens sekere fisiese moeikhede die ontwikkeling van 'n spesiale ligmeter nodig gemaak het. Hierdie meter is nou amper klaar. 'n Gunstige aspek van die wysigings wat op versoek van die provinsiale owerhede en sekere fabrikante ingevoer is, is dat nou slegs 13 in plaas van 30 afesings per truikaatsers gedoen behoeft te word.

Die groot hoeveelheid truikaatserswerk het alle spesifikasiewerk so te sê tot stilstand gebring, hoewel daar 'n geringe mate van vordering gemaak is met betrekking tot die gebruikskode vir straatverligting—'n onderwerp wat steeds meer belangstelling wek oor die hele wêreld weens die invloed daarvan op die aantal padongelukke wat voorkom.

Die werk in verband met elektriese gloeilampe (wolframgloeidrade) het gestadig gevorderd wat merkkontrole-ring betref, maar dit word nou nodig om die spesifikasie te hersien.

### Elektronika

Gereelde werk is gedoen in verband met audiometers, stophorlosies vir verkeersdepartemente, projektors vir skole en 'n groot verskeidenheid elektroniese instrumente, waarvan die interessantste dié was wat as 'n radiosnelheidsmeter vir verkeersreëling bekend staan.

Die werk wat hierdie Onderafdeling vir die Buro self doen, is amper van meer waarde as die spesifikasies wat hulle moet behartig. Hiervoor bestaan twee redes: ten eerste is die elektronikanywerheid in Suid-Afrika betreklik jonk en bestaan hoofsaaklik uit 'n aantal huishoudelike ontvangtoestelle en 'n versterkerstelsel vir openbare toe-

was reported last year as an enormous increase in work in this field proved to be negligible in comparison with the volume reached during the latter half of the year under review. It is to the great credit of this Section that it acquitted itself of the task so well. It is of interest to note that the largest of the multitude of reports prepared contained some 9,000 readings.

The number of manufacturers with permission to use the mark on their reflectors now totals six and they have, between them, manufactured upwards of  $3\frac{1}{2}$  million reflector units, some of them of a quality superior to the best imported articles hitherto examined. Insufficient resistance to corrosion at the coast has been a difficulty in some cases but the stricter requirements and tests introduced during the past year should yield an article which will satisfactorily resist corrosion.

The expected decrease in the volume of reflectors received for test has become evident. Numerous technical difficulties were experienced in modifying the Section's existing equipment to enable tests to be done in accordance with the amendments introduced in December, 1957. These amendments call for measurements at a different set of angles—in line with the practice in Britain and the United States of America—which, owing to certain physical difficulties, necessitated the development of a special light meter, still under construction but nearing completion. A favourable aspect of the amendments introduced at the request of the provincial authorities and certain manufacturers, is that it reduces the number of readings required per reflector from 30 to 13.

The large volume of reflector work led temporarily to the virtual stoppage of all specification work, although some progress was made on the code of practice for street lighting, a subject in which increasing interest is being shown all over the world, in view of its influence on the incidence of road accidents.

The work on incandescent electric (tungsten filament) lamps progressed steadily as far as mark control was concerned but the specification is now in need of revision.

### Electronics

Regular work was done on audiometers, stopwatches for traffic departments, projectors for schools and a wide variety of miscellaneous electronic instruments, the most interesting of which was what is known as a radar speed meter for traffic control purposes.

The service of the Section to the Bureau itself is of almost greater value than the specifications with which it is entrusted. There are two reasons for this: firstly, the electronics industry in South Africa is comparatively young and consists mainly of assembly of domestic receivers and public address amplifier systems and

sprake; en ten tweede koop grootkopers soos die S.A. Spoorwegadministrasie, die Departement van Pos- en Telegraafwese, en die Departement van Verdediging spesiale toerusting, waarvan die ondersoek feitlik alleen binne die stelsel waarin dit gebruik word, moontlik is.

Stappe is gedoen om die belangstelling in die swakstroomkant van die Internasionale Elektrotegniese Kommissie aan te wakker en in die komende jaar behoort duidelik te word in watter mate hierdie pogings geslaag het.

#### Algemene Fisika

Dit is 'n klein onderafdeling belas met 'n verskeidenheid werksaamhede waarvoor geen afsonderlike onderafdelings bestaan nie, maar waarvoor, alles bymekaar geneem, 'n afsonderlike onderafdeling nodig is.

'n Aantal termometer- en termokoppelkalibrerings sowel as ander fisiese toetse op materiale is uitgevoer. Gedurende die jaar het hierdie Onderafdeling die toerusting oorgeneem wat nodig is vir die fisiese sy van bedryfshigiënewerk, en een stofeltaak vir die nywerheid uitgevoer. Daar word nog aan verskeie spesifikasies gewerk, met inbegrip van dié vir oogbeskermers en lampglase vir mynwerkerslampe.

'n Vraagstuk wat tans aandag geniet, is die moontlike voorsiening van permanente en verbeterde geriewe vir hygrometerkalibrering en die meting van warmtegeleidingsvermoë.

#### Instrumente

Die werk van hierdie Onderafdeling het vernaamlik in verband gestaan met die bou van spesiale aparate hoofsaaklik vir gebruik in die Afdeling Fisika, hoewel ook elders in die Buro. 'n Aansienlike hoeveelheid veranderings aan bestaande apparaat is aangebring om tred te hou met nuwe en veranderde metodes.

Die aanskaffing van 'n tweede draaibank het baie gehelp om deur die werk te kom. Ook is 'n friesmasjien bestel. Die verbeterde toestand wat gereedskap betref, het gemaak dat baie vinniger gewerk en baie meer gedoen kon word. Daar was 'n gestadige en vinnige toename in die versoeke tot hierdie Onderafdeling gerig.

### AFDELING ELEKTROTEGNIESE INGENIEURSWESE

'n Interessante kenmerk van die verslagjaar was die groter belangstelling in gebruikskodes. Daar is bevind dat baie spesifikasies gerugsteun moet word deur 'n gebruikskode wat die keuse, installering of werking van die produk dek. 'n Bepaalde geval was dié van elektriese kables waar dit nodig geblyk het om 'n omvattende kode op te stel om optrede moontlik te maak teen die wanpraktyke wat in verband daarmee plaasvind. Dit is nogal 'n belangrike punt en daar word gevoel dat dit in Suid-Afrika met sy eie besondere arbeidsorganisasie baie

secondly, most of the big buyers such as the South African Railways Administration, the Department of Posts and Telegraphs, and the Department of Defence purchase specialized equipment, the testing of which is hardly practicable outside the system in which it is to be used.

Steps were taken to stimulate greater interest in the light current side of the International Electrotechnical Commission and the coming year should show to what extent these efforts were successful.

#### Physics General

This is a small Section entrusted with the variety of activities for which no individual sections exist but for which, taken together, a separate section is necessary.

A number of thermometer and thermo-couple calibrations were done as well as other physical tests on materials. During the year the Section took over the equipment necessary for the physical side of industrial hygiene work and completed one dust count task for industry. Work is in progress on several specifications including those for eye protectors and lamp glasses for miners' lamps.

A question now being studied is the possible provision of permanent and improved facilities for hygrometer calibration and measurement of thermal conductivity.

#### Instruments

The work of this Section was mainly concerned with the construction of special apparatus for use chiefly within the Physics Division but also elsewhere in the Bureau. A considerable amount of modification to existing apparatus was done to keep it up to date as techniques alter and develop.

The acquisition of a second lathe was a great help and a milling machine is on order. The improved tool position led to large increases in working speed and output, and the demands made on the Section increased steadily and rapidly.

### ELECTRICAL ENGINEERING DIVISION

An interesting feature of the period under review was the increased interest in codes of practice. It has been found that many specifications have to be backed up by a code of practice covering selection, installation or operation of the product. A particular case was that of electrical cables, where it was found necessary to draw up a comprehensive code to deal with the malpractices taking place in service. This is a fairly significant point and it is felt that in South Africa, with its own peculiar labour set-up, economically sound specifications can be assisted to a



nuttig sal wees om naas ekonomies gesonde spesifikasies geskikte gebruikskodes te hê.

Waarskynlik ten dele aangespoor deur die bewering dat gerieflike en betroubare uitwisseling van resultate van tegniese navorsing slegs dan kan geskied wanneer toetsmetode op internasionale grondslag gestandaardiseer word, het die Internasionale Elektrotegniese Kommissie konsepspesifikasies opgestel vir metodes om elektriese isolators en geleiers te toets. Hierdeur het die werk van die Onderafdeling Instrumente baie toegeneem, en hulle is nou in staat om die nywerheid in hierdie opsig nog meer van diens te wees.

Die kolossale taak om die Engelse en Afrikaanse Elektrotegniese Naamlys op te stel, vorder goed. Na verag word, sal hierdie werk seker nog drie jaar in beslag neem.

### **Elektriese Toestelle**

Die aantal fabrikante wat elektriese toestelle vir huishoudelike gebruik produseer, soos bv. waterverwarmers, elektriese stowe, kookplate, elektriese stryksters, broodroosters, ketels, lugverwarmers, termostate en dampelverwarmers ingevolge die standaardmerkskema het gedurende die verslagjaar op 23 te staan gekom. Dit het met 'n aansienlike hoeveelheid inspeksiewerk en kontroletoetsing gepaard gegaan.

Die hoeveelheid aannametoetswerk op verskillende elektriese toestelle met inbegrip van toetse wat vir kontrakdoeleindes op waterverwarmers hier te lande sowel as elders geproduseer vir die Kommissaris van Werke in Lusaka gedoen is, het aanmerklik toegeneem.

Die hersiene spesifikasies vir vaste elektriese opgaarwaterverwarmers en vir elektriese stowe en verwarmingsplate is voltooi en sal binnekort die lig sien. Die spesifikasie vir oondtermostate vir elektriese stowe is gepubliseer. Hierdie spesifikasie, saam met dié wat reeds vir kookplate, hittebestande kables en skakelaars uitgegee is, vul die spesifikasie vir elektriese stowe en verwarmingsplate aan; sodoende sal die vervaardiging van laasgenoemde heelwat deur standaardisering vereenvoudig word.

### **Bedradingstoebehore en Veiligheidspesifikasies**

Produsente van elektriese bedradingstoebehore skyn al hoe meer merkbewus te word, en sewe van hulle produseer tans ooreenkomstig die standaardmerkskema.

Behalwe dat hierdie onderafdeling heelwat aannametoetswerk op skakelaars, sekerings en ander bedradingstoebehore gedoen het, het hulle op uitgebreide skaal toets- en ondersoekwerk ten behoeve van die goedkeuringskomitee van die Vereniging van Munisipale Elektrisiteitsondernemings uitgevoer om die preliminêre werk in verband met appaarte waarvoor nog geen nasionale standaard bestaan nie maar wat klante by die bedrading van persele kragtens die Standaardbedravingsregulasies wil gebruik, te dek.

Na aanleiding van 'n versoek deur die V.M.E.O. is 'n begin gemaak met 'n veiligheidspesifikasie vir elektriese

great extent by the simultaneous production of suitable codes of practice.

Possibly spurred to some degree by the claim that easy and reliable exchange of technical research results can only take place if test methods are internationally standardized, the International Electrotechnical Commission produced draft standards for test methods for electrical insulators and conductors. This resulted in a big increase in the work of the Instrument Section, which is now in a position to give further service to industry in this respect.

The monumental task of compiling the English and Afrikaans Electrotechnical Nomenclature proceeds apace. It is expected, that this work will continue for at least a further three years.

### **Electrical Appliances**

The number of manufacturers producing domestic electrical appliances including water heaters, electric stoves, cooking plates, electric irons, toasters, kettles, air heaters, thermostats and immersion heaters under the standardization mark scheme was 23 during the year reviewed. This entailed a considerable amount of inspection work and control testing.

There was a marked increase in the amount of acceptance test work conducted on various electrical appliances, including tests carried out for contract purposes on water heaters produced locally and elsewhere, for the Commissioner of Works in Lusaka.

The revised specifications for fixed electric storage water heaters and for electric stoves and hotplates were completed and will shortly be published. The specification for oven thermostats for electric stoves was published. This specification, in conjunction with those already published for cooking plates, heat-resisting cables and switches, is complementary to the specification for electric stoves and hotplates; thus the manufacture of the latter will be considerably simplified through standardization.

### **Wiring Accessories and Safety Specifications**

Producers of electric wiring accessories appear to be becoming increasingly mark conscious, and seven are now manufacturing under the standardization mark scheme.

In addition to the considerable amount of acceptance test work conducted on switches, fuses and other wiring accessories, the Section carried out extensive test and investigation work on behalf of the Approvals Committee of the Association of Municipal Electricity Undertakings to cover the preliminary work on apparatus not already covered by a national standard, but which customers wish to apply to the wiring of premises under the Standard Wiring Regulations.

Resulting from a request by the A.M.E.U. a start was made on a safety specification for electric toys. Potentially

speelgoed wat in die winkels in Suid-Afrika opgemerk is en hulle vorm nog 'n groter gevaar as ander elektriese toestelle omdat hulle deur klein kinders gehanteer word wat moontlik 'n baie swak weerstand teen elektriese skok het.

Weens die belangrikheid van betroubare en deeglike aarding as 'n voorbehoedmiddel teen elektriese skok en brandgevaar, is in samewerking met die veiligheidsvoorsorgkomitee 'n begin gemaak met die werk in verband met die doeltreffendheid van aarding hier te lande, en in verband met moontlike beskermingsmaatreëls deur van goeie aardlek-refêls volgens 'n betroubare spesifikasie vervaardig, gebruik te maak.

### Kabels en Transmissie

Al die probleme in verband met 11 kV-kabels ondervind sal, na ons meen, opgelos word deur die hersiening van S.A.B.S. 97-1950 wat tans voltooiing nader. Nog belangriker sal die uitwerking van die kode vir die lê en onderhoud van kabels sowel op die nywerheid as op die verbruiker wees. Hierdie kode sal uit 10 hoofstukke bestaan en sal verseker dat die goeie werk gedoen deur kabels volgens 'n betroubare spesifikasie te bestel, nie deur slordige of ontoereikende ontwerp, legging of werking ongedaan gemaak word nie. Die spesifikasie vir PVC-kabels, S.A.B.S. 150-1950, is hersien en dek tans die veelarige, gepantserde kabels wat die afgelope paar jaar so gewild geword het, veral vir huishoudsaansluitings.

Daar is getrag om die geriewe vir die uitvoering van arbeidsfaktor-, isoleringsweerstand- en ioniseringsstoets op kabels te verbeter, aangesien daar 'n groot behoefte aan daardie geriewe in die Suid-Afrikaanse nywerheid bestaan. Daar moet nog heelwat werk gedoen word om die verwerkingstoets vir PVC-isolering, sowel vir verwarmings- as verligtingstelsels, te vervolmaak, hoewel die bestaande vereistes voldoende skyn te wees en gunstig met dié in die buiteland vergelyk.

'n Taamlik belangrike spesifikasie wat tans opgestel word, is dié vir kopergeleiers vir elektriese doeleindes. Die standaardisasie-aspek van hierdie spesifikasie sal nie alleen vir draadfabrikante van nut wees nie, maar ook vir vervaardigers van kabeltransformators en motore, en behoort tot besparings van landswyse belang te lei.

Hersiening van die rubberkabelspesifikasies het nodig geword weens die ontwikkeling van nuwe kunstrubbers wat in die nuwe spesifikasie gedek behoort te word. Dit het ook dringend noodsaaklik geword om sowel die rubber- as die PVC-spesifikasies uit te brei sodat hulle ook hoogspanningskabels dek.

Die werk in verband met die ondersoek van telefoon- en verbindingskabels het toegeneem, grotendeels vanweë die vertroue wat die Departement van Pos- en Telegraafwese tans in die plaaslik vervaardigde produk het. Die druk op die onderafdeling se geriewe was gevolglik baie groot, dog dit was 'n goeie bron van inkomste.

dangerous toys have been seen on sale in South Africa and these constitute an even greater hazard than other electrical appliances as they are handled by small children who normally have a low resistance to electric shocks.

Because of the importance of reliable and sound earthing as a prevention against electric shock and fire hazard, work was undertaken in co-operation with the Safety Precautions Committee in connection with the efficacy of earthing in this country, and of possible safeguards through using sound earth leakage relays made to a reliable specification.

### Cables and Transmission

The many problems which were experienced with 11kV cables should, it is felt, be solved by the revision of the S.A.B.S. 97-1950 now nearing completion. Still more important will be the impact of the code for the installation and maintenance of cables on industry and consumer alike. This will comprise ten chapters and should ensure that the good work of ordering cables to a reliable specification will not be undone by careless or inadequate design, installation, or operation. The specification for P.V.C. cables S.A.B.S. 150-1950 has been revised and now covers the multicore armoured type of cable which has gained popularity in recent years, especially for house service connections.

Work has been directed at improving the facilities for carrying out power factor, insulation resistance and ionisation tests on cables—a facility greatly needed by South African Industry. Much work remains to be done to perfect the polyvinyl insulation aging test for both heat and light, although the present requirements appear adequate and compare favourably with those used overseas.

A specification of some consequence being currently compiled is that covering copper conductors for electrical purposes. The standardization features of this specification will benefit, not only wire manufacturers, but also cable transformer and motor manufacturers and should result in economies of national importance.

Revision of the rubber cable specifications has become necessary in view of the development of new synthetic rubbers which should be covered in the new specification. It has also become essential to extend both the rubber and P.V.C. specifications to cover high voltage cables.

Activities in respect of testing telephone and communication cables expanded, largely because of the confidence now placed in the locally manufactured product by the Department of Posts and Telegraphs. The consequent strain on the Section's facilities was great but the earnings were very considerable.

## Elektriese Meters en Instrumente

'n Groot gedeelte van die werk deur hierdie onderafdeling gedoen, het in die roetinekalibrering van alle elektriese instrumente wat in die Buro gebruik word, bestaan.

Munisipaliteite, die nywerheid, kommersiële ingenieurs-firmas en myne het voortdurend gebruik van die geriewe gemaak wat die Buro vir die kalibrering van hul substandaard- en standaard-Kwu-meters en ander instrumente bied. Een groot firma het sy tevredenheid uitgespreek oor die baie vinnige manier waarop die kalibrering van sy instrumente uitgevoer is. Die driefase-toetsbank is na die metertoetslaboratorium verhuis om al die standaarde en substandaarde op 'n temperatuur van 20°C te hou.

Versoeke om inligting is ontvang in verband met die kalibrering van instrumente en meettransformators wat in die Unie inmeekaargesit en vervaardig gaan word. Die tyd skyn ryp te wees om die ontwikkeling van hierdie nywerheid aan te moedig deur beskikbaarstelling van nasionale spesifikasies.

Heelwat werk is gedoen in verband met die uitbreiding van standaardtoetsmetodes deur die Internasionale Elektrotegniese Kommissie ontwikkel, veral wat isolerings betref.

Die vergelykende toetse op verskillende isolerings uitgevoer om hul weerstand teen stroombaanvorming ('n taamlik belangrike eienskap in gevalle waar sodanige isolering op stokisolators vir traksiestelsels gebruik word) te bepaal, kan as voorbeeld van die nut van hierdie metodes, sowel vir die nywerheid as vir die verbruiker, aangehaal word.

## Batterye en Droë Selle

Die hersiene spesifikasie vir opgaarbatterye vir gebruik in motorvoertuie is voltooi. Die interessantste punt in hierdie verband was waarskynlik die poging wat gedoen is om te verduidelik wat 'n swaardiensbattery nou eintlik is. Hieromtrent was daar nog altyd geen sekerheid nie. Die spesifikasie dek nou 3 batterytipes, nl. klas L, klas M en klas H, eenvoudig omskryf volgens die aantal dienssiklusse wat die betrokke klas battery kan deurstaan alvorens hy onbruikbaar word. Dit behoort van nut te wees vir grootskaalse verbruikers wat nou die battery wat hulle vir 'n bepaalde voertuig, hetsy 'n personemotor- kar, 'n lorrie, 'n trekker of 'n luuksebus, nodig het, kan spesifiseer.

Die spesifikasie vir batterye vir gebruik in motorfietsse en bromponies is amper voltooi en bevat taamlik nuwe dienssiklustoetse. Hierdie spesifikasie sal vir groot- skaalse verbruikers soos bv. die Unietenderraad, van nut wees.

Behalwe die kontrole-ondersoek van batterye wat die merk dra, is baie roetientoetse op batterye gedoen vir grootskaalse gebruikers soos bv. die S.A. Spoorweg- administrasie. Dergelike werk is op droë selle en batterye uitgevoer. Bowendien is werk gedoen om die S.A.B.S.-

## Electric Meters and Instruments

A large proportion of the work carried out in this Section comprised routine calibration of all electrical instruments used in the Bureau.

Municipalities, industries, commercial engineering firms and mines made continuous use of the facilities provided for the calibration of their sub-standard and standard Kwh meters and other instruments. Considerable satisfaction was expressed by one big firm at the very expeditious manner in which the calibration of its instruments was effected. The three-phase test bench was moved into the temperature-controlled meter testing laboratory in order to maintain all the standards and sub-standards at a temperature of 20°C.

Enquiries were received in connection with the calibration of instruments and instrument transformers to be assembled and manufactured in the Union. The time appears ripe to encourage the development of this industry by the provision of national standards.

Extensive work was done in developing the standard test procedures evolved by the International Electro-technical Commission, particularly on insulations.

The comparative tests carried out on various insulations to establish their resistance to tracking (a characteristic of some importance where such insulation is used on wood-breaks for tractions systems) can be quoted as an example of the usefulness of these procedures both in industry and to the consumer.

## Batteries and Dry Cells

The revised specification for batteries for use in vehicles was completed. Probably the most interesting feature is the attempt which has been made to clarify what a heavy duty battery really is. To date there has been some confusion on this point. The specification thus covers three types of battery, viz. Class L, Class M and Class H, defined simply in terms of the duty cycles the respective class of battery can withstand before failure. This should be of help to large consumers who may now specify the battery they require for a particular vehicle, be it passenger car, lorry, tractor or luxury bus.

The specification for batteries for use in motor cycles and scooters was almost completed and incorporates fairly novel duty cycle tests. This specification will be of assistance to large consumers such as the Union Tender Board and Supplies Office.

Apart from control testing of mark-bearing batteries, much routine testing of batteries was undertaken for large-scale users such as the South African Railways Administration. Similar work was conducted on dry cells and batteries. In addition, work was done to re-align



spesifikasie in ooreenstemming met die aanbevelings van die Internasionale Elektrotegniese Kommissie te bring.

### **Die Hoogspanningslaboratorium**

Namate verbruikers 'n beter besef kry van die voordele aan stootspanningstoets op plaaslik vervaardigde transformators en isolators verbonde, neem hierdie soort werk steeds toe. Gedurende die verslagjaar is moeite met die groter eenhede ondervind, en dit sal seker die geval bly totdat die nuwe laboratorium beskikbaar is. Daar is derhalwe besluit om 'n verplaasbare eenheid vir hierdie werk te bou. Verder is daar gewerk aan 'n meer verfynde en betroubaarder metode om foute as gevolg van stootspanning op te spoor, vernaamlik gebaseer op die brug- en akoestiekbeginsels.

Die spesifikasie vir laagspanningsafleiers is voltooi, dog daar moet nog meer werk gedoen word om die betroubaarheid van die golffronttoetsing te verifieer alvorens hierdie toets in die spesifikasie opgeneem kan word. Hierdie werk het veranderings aan die stootspannings-generator noodsaaklik gemaak ten einde hierdie fasiliteit te verskaf.

Die werk in verband met die tegniek van toetsing met afgekapte golwe is voortgesit en binnekort word daar 'n begin gemaak met die werk in verband met die betroubaarheid van metings van oorslagspanning.

Heelwat roetine-toets is op isolators uitgevoer ten behoeve van fabrikante, en ook is baie aannametoets op telefoonisolators vir die Departement van Pos- en Telegraafwese gedoen.

Daar is begin aan die spesifikasies vir laag- en hoogspanningsdeurvoerings en hoogspanningsisolators, wat albei o.a. dimensionele standaardisasie sal dek om uitwisselbaarheid in die praktyk te vergemaklik.

### **Elektriese Masjiene**

Die spoedige hersiening van die S.A.B.S.-spesifikasie vir miniatuurstroomverbrekers is 'n teken van bedrywigheid op dié gebied. Dat die titel verander is tot lugstroomverbrekers dui daarop dat die nywerheid reeds so ver ontwikkel het dat hulle groter stroomverbrekers maak. Die feit dat die elektriese motorwaens wat onlangs deur die Suid-Afrikaanse Spoorwegadministrasie bestel is en wat in Brittanje vervaardig en inmeekargesit is, toegerus is met stroomverbrekers wat in Suid-Afrika gemaak is en die standaardmerk dra, is 'n verheugende verskynsel.

Daar is ook met die spesifikasie vir transformators begin. Die standaardiseringsgedeelte daarvan is gebaseer op die T-1-spesifikasie van die „C.E.A.” en sal baie help om 'n nywerheid wat tot nog toe belemmer is deur die individuele spesiale eise van verbruiker-ingenieurs, te vereenvoudig. Daar word gehoop dat verliesstandaardisering die onnodige kapitalisasieklausules wat maar al te veel in spesifikasies vir klein transformators voorkom en wat tenderbeoordeling net meer ingewikkeld maak, sal uit-skakel. Die standaardisering van isolatordeurvoerings

the S.A.B.S. specification with the recommendations of the International Electrotechnical Commission.

### **High Voltage Laboratory**

As consumers become more aware of the advantages to be gained from such tests, the impulse testing of locally manufactured transformers and insulators continues on a growing scale. Difficulty was experienced with the larger units during the period reviewed and will probably continue until the new laboratory becomes available. It was therefore decided to construct a portable unit for this work. Further work on a more sensitive and reliable means of detecting impulse failure, mainly on the bridge and acoustic principles, was also undertaken.

The specification for low voltage lightning arresters was completed but further work must be done to verify the reliability of the front of wave impulse test before this test can be included in the specification. This work has necessitated modifications to the impulse generator in order to provide the facility.

Work continued on the technique of chopped wave testing and will soon start on the reliability of flash-over voltage measurements.

A great deal of routine testing of insulators was conducted on behalf of manufacturers, in addition to much acceptance testing of telephone insulators on behalf of the Department of Posts and Telegraphs.

A start was made on the specifications for low and high voltage bushing and high voltage insulators, both of which will include dimensional standardization to facilitate interchangeability in practice.

### **Electrical Machines**

The early revision of the S.A.B.S. specification for miniature circuit breakers is an indication of activity in this sphere. That the title has been changed to air circuit-breakers signifies that the industry has grown to the extent of manufacturing larger circuit breakers. The fact that the British manufactured and assembled electric motor coaches recently ordered by the South African Railways Administration, were fitted with South African manufactured circuit breakers bearing the mark is a cause for gratification.

A start was made with the specification for transformers. The standardization features are based on the T-1 specification of the C.E.A. and will go a long way towards simplifying an industry which has, up to now, been impeded by the individual special requirements of consumer engineers. It is hoped that loss standardization will eliminate the unnecessary capitalization clauses, too often included in specifications for smaller transformers, which only complicate tender adjudication. The standardization of the insulator bushings and cable terminating boxes

en kabelentdose sal keramiefabrikante ook help om hul produkte te verbeter en sal die koste verminder.

'n Aanvang is gemaak met die werk in verband met die spesifikasie vir induksiemotors, wat ook raamwerkstandaardisering sal dek gebaseer op serie II van die I.E.K.

Behalwe dat hierdie Onderafdeling kontroletoetse op stroomverbrekers wat ingevolge die merkskema vervaardig is, uitgevoer het, het hulle ook spesifikasie- en spesiale toetse op breukperdekragsmotors, transformators en isolerings gedoen. Aannametoetse vir bewyslewing is ook ten behoeve van kliënte gedoen, en ontwikkelings-toetsfasiliteite is aan die nywerheid beskikbaar gestel.

Na aanleiding van die wens deur sommige verbruikers uitgespreek om miniaturstroomverbrekers as stroombeperkingsmiddels vir tariefdoeleindes te gebruik, is 'n subkomitee aangestel om die saak te ondersoek.

## AFDELING MEGANIESE EN SIVIELE INGENIEURSWESE

Suid-Afrika se toenemende belangrikheid in die wêreld vind sy weerspieëling in sekere aspekte van die toetswerk wat deur die Buro se Afdeling Meganiese en Siviele Ingenieurswese behartig word.

'n Bestelling vir die lewing van staalpype vir 'n groot-skaalse watertoevoerskema op Ciprus is onlangs deur die Britse Regering by 'n Kaapstadse firma geplaas en wel ondanks sterk kompetisie uit die hele wêreld. Deur 'n bepaling in die kontrak is beding dat alle pype voor verskeping deur die Buro ondersoek en goedgekeur word. Die vervaardiging van spanbetonpype deur 'n Franse firma vir Port Elizabeth se Watervermeerderingskema, wat nou ook deur die Buro se inspeksie- en toetsdienste gedek word, het baie goeie vordering gemaak.

Padtekens gelewer op 'n bestelling deur Ghana in die Unie geplaas, is ook aan inspeksie en toetsing deur die Buro onderwerp. 'n Toenemende aantal ondersoeke in verband met die verpakking van landbouprodukte wat uit die Unie uitgevoer word, is ook onderneem.

Namate Suid-Afrika se uitvoermark uitbrei, blyk dit dat die waarde van toetsing deur 'n onafhanklike en onpartydige liggaam soos die Buro met sy uitgebreide toetsfasiliteite, al hoe meer besef word.

## AFDELING SIVIELE INGENIEURSWESE

Benewens die roetinewerk wat deur hierdie Afdeling onderneem word, bied die Afdeling 'n nuwe diens aan van uiterste waarde en belang vir die betrokke liggeme, naamlik die hulpverlening aan die Stadsraad van Port Elizabeth in verband met die Watervermeerderingskema aldaar wat addisionele watertoevoer van die Churchilldam na Port Elizabeth sal meebring. Die Stadsraad het die Buro daarmee belas om namens hom toesig te hou

will also help ceramic manufacturers to improve production lines and to lower costs.

Work started on the specification for induction motors which will include frame standardization based on the Series II of the I.E.C.

In addition to control tests on circuit breakers manufactured under the mark scheme the Section carried out specification and special tests on fractional horsepower motors, transformers and insulation. Witness acceptance tests were also carried out on behalf of customers, and development test facilities were made available to industry.

As a result of the desire expressed by some consumers to use miniature circuit breakers as current limiting devices for tariff purposes a sub-committee was established to investigate the matter.

## MECHANICAL AND CIVIL ENGINEERING DEPARTMENT

A reflection of South Africa's increasing significance in world trade is afforded by certain aspects of the testing work handled by the Bureau's Department of Mechanical and Civil Engineering.

A contract for the supply of steel piping for a very large water supply scheme in Cyprus was recently placed by the British Government with a Cape Town firm in the face of keen world-wide competition. A proviso in the contract stipulated that the Bureau should inspect and approve all pipes prior to shipping. The production of prestressed concrete pipes by a French concern for the Port Elizabeth water augmentation scheme, which was also made subject to the Bureau's inspection and testing service has proceeded satisfactorily.

Road signs supplied to a contract placed in the Union by Ghana have been made subject to inspection and testing by the Bureau. An increasing number of investigations concerned with packaging of agricultural products exported from the Union has also been undertaken.

As South Africa's export market expands it is apparent that the value of testing by an independent, impartial body such as the Bureau with its wide range of testing facilities, is becoming increasingly recognized.

## CIVIL ENGINEERING DIVISION

In addition to the routine functions of this Division a new service of considerable importance and value to the parties concerned is the assistance rendered to the Port Elizabeth City Council in connection with the water augmentation scheme which will bring an additional water supply from the Churchill Dam to Port Elizabeth. The City Council appointed the Bureau to supervise the manufacturing processes of the pipes used in the scheme



oor die prosesse waarvolgens die pype wat in die skema gebruik gaan word, vervaardig word, en dit sluit ook in die toets van die grondstowwe en van die pyptoebehore, die inspekteer van die verskillende stadia van die werk en die finale hidrouliese toetse op elke pylengte. Hierdie pype is van spanbeton en word plaaslik deur die kontrakfirma vervaardig. Ten einde hierdie diens te kan lewer, was dit nodig om die Buro se personeel in Port Elizabeth te vergroot, en dit sluit dan ook nou 'n gekwalifiseerde ingenieur en inspeksiepersoneel in wat in twee skofte by die fabriek werk. Die Raad se kontrak is in verskillende stadia ingedeel. Die Buro se werksaamhede het by Stadium II begin, en die dienste wat gelewer is, is deur die Raad as in so 'n mate geslaag beskou, dat die Buro gevra is om die toesigwerk deur die gehele derde stadium deur voort te sit; die Buro het dan ook ingewillig.

Op grond van die versoeke van private organisasies ontvang, is apparate vir prestasietoetse van boumateriaal opgerig. Die toetse sluit onder andere in: die aanwending van belasting op dakke en mure om wind en veranderlike belasting met inbegrip van slag na te boots, asook die bepaling van die vermoë van mure om indringing van reën te weerstaan.

#### **Omvattende Modelbouregulasies**

Met die verskyning van deel II van die hoofstuk oor administrasie vir die Provinsie Transvaal, is tans meer as die helfte van die totale aantal hoofstukke beskikbaar. Deel III vir die Provinsie Natal is ook voltooi en vir publikasie goedgekeur. Die voltooide hoofstuk oor verligting word tans vir publikasie voorberei.

'n Gevorderde stadium is ook reeds bereik by die voorbereiding van die hoofstukke oor gewone en gewapende beton en messelwerk. Hiervan is finale konsepte opgestel en wel op so 'n wyse dat ook voorsiening gemaak word vir die nuutste ontwikkelings wat in die praktyk aangestref word. Daar is ook vordering gemaak deur die komitee wat besig is met die opstel van hoofstukke oor brandbeveiliging en ventilasie; oor laasgenoemde onderwerp word daar nuttige kommentaar ontvang van sentra wat so ver vanmekaar geleë is soos Kaapstad en Gwelo.

#### **Boumateriaalspesifikasies en Gebruikskodes**

Spesifikasies vir betondakpanne, boukalk, geglasuurde keramiekmuurteëls en toebehore, asook 'n gebruikskode vir die bevestiging van betondakpanne is gepubliseer.

Die komiteewerk in verband met die spesifikasie vir holboublokke van klei is afgehandel en die werk in verband met spesifikasies vir asbessementplate en betonpype is voortgesit. Die spesifikasie ten opsigte van betonblokke is voltooi en maak nou voorsiening vir 'n tipe blok wat vir gebruik in goedkoop behuisingskemas geskik is, asook vir blokke van ongewone vorm. 'n Konsepgebruikskode vir die waterdigmaking van geboue is opgestel wat 'n nuwe onderafdeling insluit oor kelderverdiepings en wat op metodes uit die moderne praktyk gebaseer is waardeur

on its behalf, including the testing of raw materials and fittings, inspecting the many stages of the work and the final hydraulic tests on each length of pipe. These pipes are of prestressed concrete and are fabricated locally by the contracting firm. In order to render this service it was necessary to increase the Bureau's staff in Port Elizabeth, which now includes a qualified engineer and inspecting personnel working in two shifts at the factory. The Council's contract is divided into different stages. The Bureau's activities commenced at Stage II and the services rendered were considered so successful by the Council that a request that this supervision should be continued throughout Stage III was made and accepted.

As the result of requests from private organizations, apparatus for the performance testing of building material was assembled. The tests include the application of loads upon roofs and walls to simulate wind and live-load forces including impact, as well as the determination of the ability of walls to resist penetration of rain.

#### **Comprehensive Model Building Regulations**

With the publication of Part II of the chapter on administration for the Province of the Transvaal, more than half of the total number of chapters are now available. Part III for the Province of Natal was also completed and approved for issue. The completed chapter dealing with lighting is being prepared for publication.

An advanced stage was reached in the preparation of the chapters on plain and reinforced concrete and masonry. Final drafts of these were drawn up and were designed to incorporate allowances for the latest developments encountered in practice. Progress was made by the committees producing the chapters on fire protection and ventilation, useful comments on the latter subject being received from centres as far apart as Cape Town and Gwelo.

#### **Building Material Specifications and Codes of Practice**

Specifications for concrete roofing tiles, building lime, glazed ceramic wall tiles and fittings, as well as a code of practice for the fixing of concrete roofing tiles were published.

Committee work on a specification for hollow clay building blocks was completed, and work continued on specifications for asbestos-cement sheets and concrete pipes. The specification covering concrete blocks was completed and now includes provision for a class of block suitable for use in low cost housing schemes as well as for blocks of unusual shapes. A draft of the code of practice for the water-proofing of buildings was prepared which includes a new section dealing with basements and



die gebruik van bitumineuse materiale uitgeskakel word. 'n Gebruikskode word tans opgestel waarvoor daar 'n besonder groot aanvraag behoort te wees, naamlik oor die voorwerk van geboue en die metode vir die bevestiging daarvan.

Gespesialiseerde personeel is aangestel weens die groot hoeveelheid werk in verband met die standaardisering van kantoor- en skoolmeubels. Daar is ook besluit om 'n gekwalifiseerde argitek aan te stel wat al die argitektoniese aspekte van die werk wat deur die Buro verrig word, sal behartig.

#### **Materiaaltoetsingslaboratorium**

Nadat toestemming om die standaardmerk te gebruik aan twee boukalkvervaardigers verleen is, is periodieke inspeksies, gepaard met die toetsing van monsters van hulle produkte, uitgevoer. Sement- en kalktoetse is ook uitgevoer op versoek van private en handelsorganisasies uit die hele land asook uit Njassaland en Rhodesië. Monsters vlieg-as, messesement, growwe en fyn toetslagsoorte sowel as gieterysand is ook vir toetsing en verslagdoening voorgelê.

Die baie materiale waarop toetse uitgevoer is, het onder andere ingesluit: klei- en betonteëls, boublokke van gebrande klei, as-bakstene, hol betonblokke, asbessement-rioolpype wat in Italië vervaardig is, houtgrysbord, houtveselbord en gipspleisterbord.

Die betontoetse het onder andere ook inbegryp toetse op monsters verkry uit die boor van betonkerns uit bostaande bouwerke met 'n diamantboor; hierna is die materiaalsterkte met behulp van laboratoriumondersoeke bepaal. Hierdie toetse kan van besonder groot waarde wees waar daar meningsverskille bestaan ten opsigte van die sterkte van die beton.

Daar is inspeksies uitgevoer in opdrag van staatsdepartemente in verband met hulle aankope van asbessementplate en betonpype. Inspeksies kragtens die merkskema is gedoen ten opsigte van fabrieke wat met sout geglasuurde pype en toebehore, asbessementpype onder druk en gipspleisterbord vervaardig.

Daar word tans addisionele apparatuur aangeskaf om voorsiening te maak vir die toename in die volume en verskeidenheid van die werk en daar is dan ook gedurende die verslagtydperk bestellings geplaas vir 'n 40-ton hidrouliese drukmasjien en 'n apparaat vir die bepaling van die relatiewe ontvlambaarheid van verskillende boumateriale. Die uitrusting wat ontvang is, het onder andere 'n sandstraalkabinet en meganiese skudders ingesluit.

### **AFDELING MEGANIESE INGENIEURSWESE**

#### **Laboratorium vir Meganiese Ingenieurswese**

Die aantal versoeke om toetse gedurende die verslagjaar het aansienlik toegeneem in vergelyking met die aantal in die jaar daarvoor en daar is toetse uitgevoer in opdrag van staatsdepartemente, provinsiale admini-

strating methods based on modern practice, eliminating the use of bituminous materials. A code of practice being drawn up for which there should be considerable demand is that dealing with the facings of buildings and their method of attachment.

In order to deal with the volume of work in connection with the standardization of office and school furniture, specialist staff has been appointed. It was also decided to appoint a qualified architect to undertake all architectural aspects of work handled in the Bureau.

#### **Materials Testing Laboratories**

With the granting of the standardization mark to two building lime producing companies, periodic inspections together with the testing of samples of their products were carried out. Cement and lime tests were also conducted in response to requests from private and commercial organizations throughout this country as well as from Nyasaland and Rhodesia. Samples of fly-ash, masonry cement, coarse and fine aggregates, including foundry sand were also submitted for tests and reports.

Among the many materials upon which tests were conducted were clay and concrete tiles, burntclay building blocks, ash bricks, hollow concrete blocks, asbestos-cement sewer pipes of Italian manufacture, wood chip-board, wood fibreboard and gypsum plasterboard.

Included in the tests on concrete were those performed on samples obtained by the drilling of cores of concrete from existing structures by means of a diamond drill and then determining the strength of the material by subsequent laboratory tests. These tests can be of particular value where a difference of opinion exists regarding the strength of the concrete.

Inspections were carried out on behalf of government departments in connection with their purchases of asbestos-cement sheets and concrete pipes. Inspections under the mark scheme were conducted in respect of factories producing salt-glazed pipes and fittings, asbestos-cement pressure pipes, and gypsum plasterboard.

Additional apparatus to cope with the increased volume and variety of work is being acquired and during the period under review orders were placed for a 40-ton hydraulic compression machine and an apparatus for determining the comparative flammability of various building materials. Equipment received included a sand-blasting cabinet and mechanical vibrators.

### **MECHANICAL ENGINEERING DIVISION**

#### **Mechanical Engineering Laboratory**

Requests for tests during the year reviewed showed a marked increase on those for the previous year, tests being carried out for government departments, provincial administrations and private industries on a wide variety



strasies en private nywerhede op 'n groot verskeidenheid artikels van skarniere vir teaterstoelstiplette tot ketelinstallasies. Altesaam 465 toetsverslae is gedurende die jaar uitgereik.

Daar is 'n interessante neiging opgemerk, naamlik dat groot private ondernemings hulle aankope van gebruiksgoedere liewers op vergelykbare prestasietoetse baseer wat op monsters van die artikels aangebied, uitgevoer is, as op prysvergelykings.

'n Uitvoerige reeks toetse is op die ketelinstallasie van 'n pas-opgerigte fabriek in Suid-Afrika uitgevoer om vas te stel of die ketelinstallasie soos dit daar opgerig is, aan die bepalings in die waarborg van die kontrak uiteengesit, voldoen.

Die onderafdeling vir enjintoetsing het 'n aansienlike hoeveelheid werk aangepak deur die uitvoering van vergelykende toetse tussen plaaslik vervaardigde dieselandstof en die ander wat in die handel verkrygbaar is. Op die gebied van swaar smeerolie is baie toetswerk gedoen in verband met die oprigting en die stel van toetsenjins vir gestandaardiseerde smeerolie om hulle volgens internasionale spesifikasies te laat loop.

'n Versoek is namens die Regering van Ciprus ontvang vir die keuring van gesweiste staalpipe met 'n groot deursnee wat vir 'n nuwe watervoorsieningskema bestem is. Dit het weer die oorpasing van twee voltydse inspekteurs na die fabriek nodig gemaak ten einde elke pyp te laat toets en sertifiseer.

Die kalibreereenheid vir toetsmasjiene van die afdeling was vanjaar besonder bedrywig; altesaam 62 trekvastheidstoets- en druktoetsmasjiene asook ykringe is gekalibreer.

Toetse vir kontroledoelendes kragtens die standaardmerkskema is uitgevoer op sweiselektrodes, staalgeleierbuis, verbindingspipe van smeegietyster, elektriese geleierbuis, silindervoerings, waterkrane en suierringe. Daar was 'n aansienlike toename in die aantal aansoeke om toestemming om die standaardmerk op verskillende artikels te mag gebruik.

### **Metrologie**

By hierdie Onderafdeling was daar ook 'n aansienlike toename in die aantal versoeke ontvang om toetse en kalibrerings, en daar is 276 toetsverslae uitgereik. Die getoetste artikels wissel van hipodermiese spuite tot ploegskywe. Dit het weereens geblyk dat nyweraars steeds meer besef hoe belangrik dit is om hulle meetinstrumente en ykmate van tyd tot tyd te laat toets om absolute noukeurigheid by die produksie te verseker. As gevolg hiervan is daar talle versoeke ontvang om die kalibrering van instrumente soos blokpasmate, skroefdraadpasmate, wyserplataanwysers, mikrometers, noniuspasmate en reioute.

Die Buro het die hoë standaard van keuring ten opsigte van verbruikersgoedere deur provinsiale administrasies, staatsdepartemente en ander grootverbruikers aangekoop en waarvan die toetsing aan die Buro opgedra is, nog

of articles ranging from hinges for theatre chair seats to boiler plant. A total of 465 test reports was issued during the year.

An interesting development was that large private organizations based purchases of commodities on comparative performance tests carried out on samples of the articles tendered rather than on comparison of price.

An elaborate series of tests was carried out on the boiler plant of a newly established industry in South Africa to determine whether the boiler plant as installed complied with the guarantee given in the contract. The engine test section undertook an increasing amount of work in performing comparative tests between locally produced diesel fuel and those fuels commercially available. In the field of heavy duty lubricating oil testing, much work was done on the setting up of and adjusting the standardized lubricating oil test engines to run to international specifications.

A request was received from the Government of Cyprus for the inspection of large diameter welded steel waterpipes to be used in a new water supply scheme. This necessitated the posting of two full-time inspectors at the factory so that every pipe could be tested and certified.

The testing machine calibrating unit of the Division was extremely active during the year and a total of 62 tensile and compression machines and proving rings were calibrated.

Tests for control purposes under the standardization mark scheme were carried out on welding electrodes, steel conduit, malleable cast iron pipe fittings, electrical conduit, cylinder sleeves, water taps and piston rings. There was a marked increase in the number of applications for permission to use the standardization mark on various articles.

### **Metrologie**

This Section also experienced a pronounced increase in the number of requests received for tests and calibrations and 276 test reports were issued. The items tested ranged from hypodermic syringes to plough discs. It was again evident that to an increasing extent industrialists are realizing the importance of having their measuring instruments and gauges verified from time to time to ensure absolute accuracy of production. Consequently, requests for the calibration of instruments such as slip gauges, screw thread gauges, dial indicators, micrometers, vernier calipers and straight edges were received.

The usual careful standard of inspection of commodities purchased by provincial administrations, government departments and other large consumers, the testing of which had been delegated to the Bureau, was maintained, thus ensuring that the delivered consignments of articles



steeds gehandhaaf en aldus verseker dat die afgelewerde besendings artikels aan die vasgestelde vereistes voldoen. As gevolg van hierdie streng keuringstelsel kan die verbruiker nou beter gebruik maak van beskikbare fondse aangesien hy verseker kan wees dat hy ware van die vereiste gehalte ontvang. Grootverbruikers besef al hoe meer die waarde van hierdie streng keuringstelsel en daar was gevolglik ook 'n aansienlike toename in die hoeveelheid versoeke om keuring. Die gekeurde artikels dek 'n wye veld van boue, moere en klinknaels tot gietysterhulpstukke van 5 vt. deursnee vir 'n munisipale water-netwerkstelsel. 'n Verdere interessante ontwikkeling was die groter aantal hospitaalowerhede wat inspeksie van hospitaalmeubels verlang het om sodoende te verseker dat alle meubels wat in die hospitale gebruik word aan die hoë afwerkingstandaard soos in die spesifikasie voorgeskryf, beantwoord.

### Spesifikasies

Ses spesifikasies en een gebruikskode is afgehandel; daarvan was 'n paar van belang vir munisipaliteite, die nywerheid en die boeregemeenskap, naamlik gietysterhulpstukke vir asbesementype onder druk, gietysterskuifafsluiters, krukke, sagtestaalklinknaels, draadsnytappe, stik- en kramdraad en 'n kleurkode vir werkplase en fabriekke.

Spesifikasies vir bedryfsveiligheid en gebruikskodes het aandag geniet en daar word tans gewerk aan die identifikasie van pyplyne, steierwerk, die installering, onderhoud en opberging van slypwiele, en veiligheids-helms.

### Verpakking

Die grootste gedeelte van die werk wat deur hierdie onderafdeling uitgevoer is, het bestaan uit die ondersoek van monsters wat uit besendings vyllaagpapiersakke vir kunsmis geneem is, om te bepaal of hulle aan die vereistes van 'n private spesifikasie voldoen. Daar is ook toetse uitgevoer op veelwandige papiersakke vir sement en kalk. Onder die verpakkingsmonsters wat getoets is, was daar verskeie verpakkingsmiddels vir insektedoders in poeier-vorm, houtkrate vir 50 pd. aartappels, glasflesse vir voedselsmere vir verpakking in riffelborddose, en poliëtileensakke vir gebruik as voerings vir goingsakke as verpakking vir 112 pd. chemikalieë in poeiervorm.

'n Groot verskeidenheid ander artikels is getoets soos o.a. pakpapiertjies vir vrugte, briefhoofpapier, waspapier vir verpakking, kraftpapier vir sakke, poliëtileenflesse vir elektroliet, dekkings en riffelmedia vir riffelbord, en riffelborddose vir appels, botter, springpatrone, dopplonte, ingemaakte voedsel, druiwe en aartappels.

Daar is begin met 'n ondersoek na die verpakking van suiker. Die goingsak vir suiker wat tans in gebruik is, hou nie vreemde stowwe uit nie en derhalwe moet daar 'n higiëniese verpakking gevind word. Die ondersoek is aan die begin hoofsaaklik op goingsakke met ver-

complied with the specified requirements. As a result of this strict inspection control better use can be made of available funds by the consumer as he can be sure of receiving articles of the required quality. Large consumers are realizing the value of this strict inspection and requests for inspection showed a marked increase. The articles inspected ranged from bolts, nuts and rivets to 5 ft. diameter cast iron fittings for a municipal water reticulation scheme. An interesting development was the increased number of hospital authorities which requested inspections on hospital furniture in order to ensure that all the furniture used in hospitals was of the high standard of workmanship demanded in the specification.

### Specifications

Six specifications and one code of practice were completed, among them several of interest to municipalities, industry and the farming community, namely, cast iron fittings for asbestos-cement pressure pipes, cast iron gate valves, crutches, mild steel rivets, screwing taps, stitching and stapling wire, colour code for workshops and factories.

Industrial safety specifications and codes of practice received attention and work is in progress on the identification of pipe lines, erection of scaffolding, installation, maintenance and storage of grinding wheels, and safety helmets.

### Packaging

The major portion of the test work carried out by the Section consisted of the examination of specimens drawn from consignments of 5-ply paper sacks for fertilizer, for compliance with a purchasing specification. Tests were also undertaken on multiwall paper sacks for cement and lime. Among the specimen packages tested were various packs for powdered insecticide, wooden crates for carrying 50 lb. potatoes, glass jars for food paste for packing in corrugated board boxes, and polyethylene bags used as liners in hessian bags to contain 112 lb. powdered chemical.

A wide range of other items was tested including fruit wrappers, letterhead paper, waxed wrapping paper, sack kraft, polyethylene bottles for electrolyte, liners and corrugating medium for corrugated board, and corrugated board boxes for apples, butter, blasting cartridges, capped fuses, canned foods, grapes and potatoes.

An investigation into the packaging of sugar was commenced. The present hessian sugar pocket does not prevent the entry of foreign matter and a more hygienic pack is required. The investigation was commenced primarily on hessian sacks with various inner laminates



skillende binnevoerings of dekkings beperk, maar dit sal nog na veelwandige papiersakke uitgebrei word.

Private spesifikasies vir waspapier vir verpakking en verskeie tipes skryfbehoeftes is vir 'n groot organisasie opgestel en verdere spesifikasies vir die papierbord wat tans deur die organisasie se drukafdeling gebruik word, is tans in voorbereiding.

Die werk i.v.m. standaardspesifikasies en gebruikskodes vir die verpakking van gevaarlike goedere met uitsluiting van plofstowwe is voortgesit, maar die vordering was uit die aard van die saak bra stadig as gevolg van die groot aantal handelsartikels wat behandel en die groot verskeidenheid verpakings wat gespesifiseer moes word. Nadat hierdie dokumente finaal aanvaar is, sal hulle as grondslag dien vir die regulasies wat die vervoer van alle gevaarlike goedere met uitsondering van plofstowwe in die Unie sal beheer.

In samewerking met die Instituut van Markmeesters van Suid-Afrika word tans 'n spesifikasie vir die verpakking van markprodukte opgestel en na verwag word, sal hierdeur die groot verskeidenheid houers van verskillende grootte tot 'n paar basiese groottes houthouers en sakke afgebring word. Daar word gevoel dat standaardverpakings wat gerieflik gestapel kan word, dit moontlik sou maak om die dikwels beperkte vloerruimte op baie munisipale markte op die voordeligste wyse te benut. Die spesifikasie maak ook voorsiening vir die gebruik van ander materiale as hout waar dit op bevredigende wyse deur sodanige materiale vervang kan word.

'n Kaart met die nuwe kleurmerking van gassilinders vir mediese doeleindes is uitgegee en die hersiene gebruikskode vir die kleurmerking van hierdie silinders word tans vir publikasie voorberei. Die nuwe kleurmerkings voldoen aan die vereistes van die aanbevelings gedoen deur die Internasionale Standaardiseringsorganisasie en daar word gehoop dat sodra een gemeenskaplike kleurskema in die hele Suidelike Afrika in gebruik is, die moontlikheid dat per abuis die verkeerde gas gebruik word, grotendeels verminder gaan word.

Daar is vordering gemaak met die spesifikasie vir glasbottels vir die dranknywerheid en die werk i.v.m. die spesifikasies vir riffelborddose vir verskillende handelsartikels (met inbegrip van sitrus- en sagtevrugte is voortgesit.

Die oorspronklike spesifikasies vir gassilinders het hoofsaaklik die silinders vir nywerheidsgebruik behandel en het kleiner houers vir vloeibare petroleumgas vir huisgebruik nie gedek nie. Met die oog op die vinnige uitbreiding in die gebruik van vloeibare petroleumgas is dit nodig geag om verskillende wysigings in die gassilinderspesifikasies aan te bring, sowel as in die gebruikskode wat sy gebruik sal dek.

Wysigings van die spesifikasies vir vertinde melk- en roomkanne is oorweeg met betrekking tot die standaardisering van die deksel- en nekgroottes.

or liners, but will be extended to include multiwall paper sacks.

Purchasing specifications for waxed wrapping paper and for various types of stationery were prepared for a large organization, and further specifications for the paperboard used by its printing department are in course of preparation.

Work on the standard specifications and code of practice for the packaging of dangerous goods other than explosives continued, but progress was necessarily slow in view of the large number of commodities dealt with and the wide range of packages specified. When finally accepted, these documents will form the basis for the regulations covering the transportation of all dangerous goods in the Union other than explosives.

In conjunction with the Institute of Market Masters of South Africa, a specification is being prepared for packages for market produce, by which means it is hoped to reduce the large number of different sizes of containers in present use to a few basic sizes of wooden containers and bags. It is considered that standard packages which can be conveniently stacked, would allow the best use to be made of the often limited floor space available in many municipal markets. The specification also provides for the use of materials other than wood where these can be substituted satisfactorily.

A chart illustrating the new colour marking of medical gas cylinders was issued and the revised code of practice for the colour marking of those cylinders is in course of publication. The new colour markings comply with the requirements of recommendations made by the International Organization for Standardization and it is hoped that once a common colour scheme is in use throughout Southern Africa, the possibility of the accidental use of an incorrect gas will be appreciably reduced.

Progress was made with the specification for glass bottles for the liquor industry and work on the specifications for corrugated board boxes for various commodities (including citrus and deciduous fruits) continued.

The original specifications for gas cylinders dealt primarily with the cylinders used in industry and were not applicable to the smaller containers for liquefied petroleum gas for domestic use. In view of the rapid expansion in the use of liquefied petroleum gas, it was deemed necessary to make various amendments to the gas cylinder specifications and the code of practice which would cover its usage.

Amendments to the specification for tinned steel cans for milk and cream were considered in regard to the standardization of lid and neck sizes.



## DIE KAAPSTADSE KANTOOR

Die werksaamhede van die Kaapstadse kantoor het gedurende die verslagjaar uitgebrei; waar hulle hul eers hoofsaaklik op die keuring en ondersoek van ingemaakte vrugte en tekstiel toegelê het en op uitgebreide skaal roetinemonsterneming in die Kaap en die Suidwestelike distrikte vir al die ander afdelings van die Buro gedoen het, het hulle nou ook die sekretariële pligte i.v.m. die werk van die Streeksnavorsingskomitee van die Westelike Provinsie op hul geneem en was behulpsaam by die skakelwerk van die W.N.N.R. Sodoende vorm hulle 'n skakel tussen die Raad en die plaaslike, georganiseerde nywerheid en wetenskaplike en tegniese institute. Versoeke om inligting en toetse is na die hoofkantoor afgelei. Brosjures wat inligting omtrent navorsing en standaardisering bevat, is onder nyweraars, vakblaaie en tegniese tydskrifte, professionele liggame en Universiteitsdepartemente uitgedeel. Hulp is verleen by die reëling van die inleidingslesing van 'n landswyse veldtog om die gebruik van radioisotope in die nywerheid en by nywerheidsnavorsing te bevorder, en in samewerking met die Raad se skakelafdeling, is 'n uitstalling by die Wetenskaplike Tentoonstelling wat in Maart 1958 in Kaapstad gehou is, gereël.

Die toenemende waardering van die funksies van die Suid-Afrikaanse Buro vir Standaarde en die dienste wat deur die Buro aan die nywerheid gelewer kan word, sowel as van die standaardmerkskema was baie opvallend onder verbruikers en fabrikante. Die aantal fabriek in Kaapland wat goedere produseer met die standaardmerk daarop, het gedurende die verslagjaar tot 46 gestyg. Hierdie fabriek omvat vier wat vrugte, groentes en konfynt inmaak en wat vis inmaak en snelbevore vis produseer, 'n voedsel- en kruideryefabriek, ag fabriek vir die bottel van bruisdranke, een roomys- en yslekkersfabriek, vyf pluimveevoerfabriek, drie verpakkings-middelefabriek wat riffelbordhouers vervaardig, een politoerfabriek, drie asbessementpypfabriek, een boukalkbrandery, drie fabriek wat elektriese apparate en toestelle vervaardig, twee verffabriek, een skoefabriek, een tekstielfabriek, een fabriek wat handdoekstof vervaardig en die werkwinkels van 8 juweelmakers.

Die kontak tussen die Buro en die nywerheid in Kaapland was egter geensins tot fabrikante wat ingevolge die standaardmerkskema produseer, beperk nie, en nou samewerking is deur die Kaapstadse kantoor bewerkstellig met die Kaapse Kamer van Nywerhede en die Kaapstadse Kamer van Koophandel. Met die samewerking van plaaslike invoerders het die skema vir monsterneming uit alle besendings ingevoerde, ingemaakte vis en ingemaakte vleisprodukte glad van stapel geloop en is dit verbind met die uitvoering van inspeksies kragtens die betrokke verpligte spesifikasies by die 17 vis- en kreefinmaakfabriek aan die Weskus en die twee visinmaakfabriek en twee fabriek wat vleisprodukte op die Skiereiland inmaak.

## CAPE TOWN OFFICE

The functions of the Cape Town Office were extended during the past year; where it had previously concentrated mainly on the inspection and examination of preserved foods and textiles and carried out extensive routine sampling in the Cape and South-Western districts on behalf of all other divisions of the Bureau, it has now undertaken the secretarial duties in connection with the work of the Western Province Regional Research Committee and has assisted in the liaison of the C.S.I.R., thus forming a link between the Council and local organized industry and scientific and technical institutions. Requests for information and tests were channelled to head office. Research and standardization information brochures were distributed to industrialists, trade and technical journals, professional bodies and University departments. Assistance was given in arranging the initiating lecture of a Union wide campaign to promote the use of radio-isotopes in industry and industrial research and, in conjunction with the Council's Liaison Division, an exhibit was arranged at the Science Exhibition held in Cape Town during March, 1958.

Increasing appreciation of the functions of the South African Bureau of Standards, the services it is able to render to industry, and of the standardization mark scheme, by both consumers and manufacturers, was very marked. The number of factories in the Cape area, producing goods to which the standardization mark is applied increased to 46 during the year under review. These factories comprise four fruit, vegetable and jam canneries, a fish canning factory and quick-frozen fish plant, a foodstuffs and condiment factory, eight mineral water bottling plants, an ice-cream and a water sucker factory, five poultry feed mills, three packaging factories manufacturing corrugated cardboard containers, a polish factory, three asbestos-cement pipe factories, a building lime works, three factories manufacturing electrical apparatus and appliances, two paint factories, a footwear factory, a textile mill, a towelling factory and the workshops of eight manufacturing jewellers.

Contact between the Bureau and industry in the Cape, however, was by no means limited to manufacturers producing under the standardization mark scheme, and close liaison was established by the Cape Town office with the Cape Chamber of Industries and the Cape Town Chamber of Commerce. With the co-operation of local importers the scheme for the sampling of all consignments of imported canned fish and canned meat products proceeded smoothly and was integrated with the carrying out of inspections in connection with the relevant compulsory specifications at the 17 fish and rock lobster canning factories along the West Coast and the two fish canneries and two factories manufacturing canned meat products in the Peninsula.

Growing co-operation with industry in the Cape was indicated by the greatly increased number of requests for



'n Bewys van die toenemende samewerking met die nywerheid in die Kaap is die baie groter aantal versoeke om toetse en keurings wat deur die Kaapstadse kantoor van die Buro van alle takke van die nywerheid in die Westelike Provinsie en die Suidwestelike distrikte ontvang is. Hierdie versoeke het o.a. inspeksie en toetsing van ingenieursmateriale en masjienerie gedek, sowel as verpakkingsmateriaal, plastika en allerhande chemiese produkte, voedsel en voer, en leer- en tekstielware. Die hoeveelheid werk deur die Kaapstadse tekstielinspekteur gedoen het ook steeds toegeneem en hy was voltyds besig met besendinginspeksies en monsterneming uit tekstiel-goedere, asook met die knip, maak en versiering van klere in opdrag van die Unieraad vir Tenders en Leweransies, die S.A. Spoorwegadministrasie en verskillende ander staatsdepartemente en provinsiale administrasies. Behalwe dat hy al hierdie werk gedoen het, het hy nog inspeksiewerk vir die Departement van Handel en Nywerheid gedoen in verband met die goewermentsregulasies oor die etikettering van wol in Kaapstad en die plattelandse gebiede in die Westelike Kaap en het hy ook nog sy werksaamhede uitgebrei tot die Oostelike Provinsie.

Volgens ooreenkoms is lyste van nuwe en hersiene spesifikasies wat ontvang is, deur die Kaapse Kamer van Nywerhede in sy weeklikse nuusbrief gepubliseer, en al gou het lede na die nuwe aanwinste verneem en bestellings vir eksemplare geplaas.

## DIE DURBANSE KANTOOR

Nog twee beamptes is tydens die verslagjaar op die personeel van die Durbanse Takkantoor aangestel. Een beampte is as monsternemer, en die ander as tekstielinspekteur aangestel om die werk in verband met die merkskema te doen en ook om die woletiketteringsregulasies toe te pas, buiten en behalwe roetinemonsterneming en inspeksie.

Alle suikerraffinaderye in Natal skyn daarvan bewus te wees hoe voordelig dit is om onsigbare gebreke in swaarbelaste meulrollers wat indien nie betyds ontdek nie tot groot reparasieonkoste sou kan lei, op 'n vroeë tydstop te kan vasstel. Die buiteseisoense ultrasoniese toetswerk by die raffinaderye was amper voltooi. Daar is met onderhandelings begin om hierdie diens uit te brei tot die suikerraffinaderye op die eiland Mauritius. Foto's van ossilloskoopspore van meul-asse gemaak, is geneem om 'n begin met 'n stelsel van verslaghouding en bewyse te maak.

Verskeie skepe is geïnspekteer om te sien of daar gebreke in hul agterstewenasse, stoomketels en bodemplate was, en krukasse van dieselmotore en opgaartenks is radiografies vir die oliemaatskappye ondersoek om die gehalte van die sweisnate te bepaal. In opdrag van plaaslike ingenieursfirmas is 'n groot aantal krukasse, silinderkoppe, dakkappe, kleppe, suiers en ander enjinonderdele

tests and inspections that were received by the Cape Town office of the Bureau from all branches of industry in the Western Province and South Western districts. These requests covered inspections and tests for engineering materials and machinery, packages and packaging materials, plastics and all manner of chemical products, foods and feedstuffs, and leather and textile goods. The volume of work undertaken by the textile inspector stationed in Cape Town also continued to expand and he was fully occupied with consignment inspections and the sampling of textile merchandise as well as with the cut, make and trim of clothing on behalf of the Union Tender Board and Supplies Office, the South African Railways Administration and various other government departments and provincial administrations. Apart from this work he continued carrying out inspections on behalf of the Department of Commerce and Industries in connection with the government wool-labelling regulations in Cape Town and Western Province country areas and extended his previous field of activity to the Eastern Province.

By arrangement, lists of new and revised standards received were published by the Cape Chamber of Industries in its weekly newsletters, and members were quick to refer to these new accessions, and to place orders for copies.

## DURBAN OFFICE

Two more officers were appointed to the staff of the Durban Branch Office during the course of the past year, one being appointed as a sampler and the other as a textile inspector to administer the work entailed by the Mark Scheme and also to administer the wool labelling regulations in addition to routine sampling and inspection.

All sugar mills in Natal appear to be aware of the benefits derived from early diagnosis of invisible defects in highly stressed mill rollers likely to cause costly breakdowns. Off-season ultrasonic testing at the mills was almost completed. Negotiations were commenced to extend this service to the sugar mills at the island of Mauritius. Photographs of oscilloscope traces obtained from mill shafts were taken to initiate a system of records and evidence.

Several ships were inspected for flaws in their tailshafts, steam drums and bedplates and crankshafts of diesel engines and storage tanks were examined radiographically for the oil companies to determine the quality of the welded seams. For local engineering firms a large number of crankshafts, cylinder heads, roof trusses, valves, pistons and other engine components were examined for possible flaws using ultrasonic, radiographic or magnetic techniques. Approximately 120 sugar mill roller shafts were examined before new shells were fitted.



ondersoek met gebruik van ultrasoniese, radiografiese, of magnetiese metodes om moontlike gebreke vas te stel. Ongeveer 120 asse van suikermeulwalse is ondersoek alvorens nuwe omhulsels daarom aangebring is. Hierdeur was dit nodig om ongeskikte asse aan masjienbewerking te onderwerp. Sommige van hierdie asse het van suiker-raffinaderie op Mauritius gekom en ander van Uganda, Mosambiek, Kenia en die Belgiese Kongo.

Radiografiese ondersoek van hoogspanningskakeltuig vir die Elektrisiteitsvoorsieningskommissie het die oorsaak van onlangse kragweiering vasgestel. Kragstasieketels is ondersoek om die aanwesigheid van gebreke vas te stel en in sommige gevalle die grootte van sulke gebreke.

Hoewel minder nie-vernietigende toetswerk gedoen is by groot bouwerke, was die aanvraag om toetse van kort duur groter as tevore, en ook die skeepsbedryf het meer gebruik van die beskikbare toetsgeriewe gemaak.

Gedurende die verslagjaar het nog 'n vleis- en visinmaakfabriek in Natal begin produseer. Hierdie fabriek het in 1957 vis en in 1958 vleis begin inmaak. Die gehalte van hulle produksie was goed.

In die Durban-gebied is daar nou vyf fabriek wat ingevolge die verpligte standaardspesifikasie vir ingemaakte vleis en vis inmaak.

Monsterneming van ingevoerde ingemaakte vleis- en ingemaakte visprodukte ingevolge die verpligte spesifikasies het gedurende die verslagjaar aanmerklik toegeneem. Dit was waarskynlik te wyte aan die groot toename van invoer uit die Verre Ooste waarvoor Durban gewoonlik die eerste hawe is wat aangedoen word. Die monsters is meestal in die kaaipakhuis geneem, maar meer samewerking is stadigaan deur plaaslike klarings-agente verleen wat dit moontlik gemaak het om meer monsterneming in plaaslike pakhuis te doen.

Kontroletoeitswerk en inspeksies is gereeld by vier pluimveevoerfabrieke, drie insekte- en ontsmettings-middelfabrieke, vier bruisdrankfabrieke, een trukaatsfabriek en twee tekstielfabrieke gedoen. Drie van bogenoemde fabriek het gedurende die verslagjaar toestemming gekry om die Buro se standaardmerk te gebruik. Gereelde kontrolemonsterneming is uitgevoer ten opsigte van verdowings-eter, remvloeistof, silwerware, kouwaterdistemper, witsel, drukkersmetaal, houtverduur-samingsmiddels, hergeraffineerde olie en ghries. Vier van hierdie fabrikante het gedurende die jaar toestemming gekry om die merk te gebruik.

Monsterneming ingevolge die aannameskema het toegeneem in vergelyking met verlede jaar, en het verf, verfverwyderingsmiddels, sokkies, truie, onderklere, komberse, handdoeke, papiersakke, loodhulse en bedpreie gedek.

Namate dit nodig geword het, is reëlings getref vir die behoorlike onderhoud van die verfblootstellingsplekke in en om Durban.

Dit was opvallend gedurende die verslagjaar dat die Buro en die Buro se werksaamhede baie meer bekendheid

This obviated machining of unsuitable shafts. Some of these shafts came from sugar mills in Mauritius, Uganda, Mozambique, Kenya and the Belgian Congo.

Radiographic examination of high tension switchgear for the Electricity Supply Commission established the cause of recent power failures. Power station boilers were examined to determine the presence and, in some instances, the extent of flaws.

Although less non-destructive testing work was done on large erection schemes, the demand for tests of short duration was greater than before, and use of the testing facilities was also made to an increasing extent by the shipping industry.

During the period under review a further factory canning meat and fish started production in the Natal area. This factory commenced fish canning operations in 1957, and meat canning in 1958. Its production was found to be of good quality.

Five factories are canning under the compulsory standard specification for canned meat and fish in the Durban area. During the period under review 664 production batches from all the factories were inspected and incubated. Samples from these batches were despatched to Pretoria.

Sampling of imported canned meat and canned fish products under the administration of compulsory specifications increased considerably during the period under review. This was probably due to the substantial increase in imports from the Far East, for which Durban is usually the first port of call. Sampling was mostly done in berth warehouses but better co-operation was gradually given by local clearing agents which enabled more sampling to be done at local warehouses.

Control testing and inspections were regularly carried out at four poultry feed factories, three insecticide and disinfectant factories, four mineral water factories, one retro-reflector manufacturing firm and two textile factories. Three of the factories referred to above received permission to use the Bureau's standardization mark during the period under review. Regular control sampling was carried out in respect of anaesthetic ether, brake fluid, silver ware, cold water distemper, whitening, printer's metal, wood preservatives, re-refined oil and grease. During the year four of these manufacturers were granted permission to use the mark.

Sampling under the acceptance scheme showed an increase as compared with the previous year and involved paint, paint remover, socks, jerseys, underwear, blankets, towels, paper sacks, lead sleeves, and counterpanes.

Arrangements were made as and when necessary for the proper maintenance of the paint exposure sites in and around Durban.

It was evident during the period under review that the Bureau and the Bureau's activities are becoming much better known in Natal. Industry especially, seemed to show increased appreciation of the benefits to be derived



in Natal verwerf het. Veral die Nywerheid het, na dit wil voorkom, duideliker begin beseef watter voordeel daar uit die S.A.B.S. se standaardspesifikasies en die standaardmerkskema getrek kan word, en vanweë hierdie feit is daar baie meer navrae ontvang as die jaar tevore. Daar was weer 'n gereelde vraag na S.A.B.S.- en Britse spesifikasies en die spesifikasies in hierdie kantoor in voorraad gehou, is dikwels geraadpleeg.

## PORT ELIZABETHSE KANTOOR

Nuwe en groter kantoorruimte langs die voormalige kantoorgeboue geleë, is in gebruik geneem en dit het dan ook aansienlik bygedra tot groter gerief en doeltreffendheid.

'n Toename in die aantal versoeke om alle tipes toetse is ondervind, en die produkte wat gehanteer en vir toetsing na Pretoria gestuur is, het onder andere ingesluit: bituminese kurkvulstowwe, boubord, kables, doringdraad, staalasse, motorbatterye, rubber, gietyster en lym. Die kalibrering van toetsapparatuur is ter plaatse gedoen asook nie-vernietigende toetse op groot opgaarhouers van staal, staalsleepstange vir sleepwaens, en sweislasse. Namens aankooporganisasies is daar keuringswerk gedoen i.v.m. verfsoorte, verfkwaste, kisplankies, verduursamingsmiddels, wolvetamestellings en motorbatterye.

Die tweede stadium van Port Elizabeth se munisipale watervermeerderingskema, waarvoor die Buro met inspeksiewerk belas is, maak tans goeie vordering. Die Buro is ook gevra om toesig oor die derde stadium van die werk te hou wat van dieselfde omvang gaan wees as dié van die tweede stadium. Alleen die koste van die betonpype wat by hierdie projek gebruik gaan word, word reeds op £1,800,000 geskat. Die Stadsraad van Port Elizabeth beskou die Buro se dienste as 'n vorm van assurance t.o.v. die belegging wat hy in die vervaardiging van die pype maak. 'n Verantwoordelike ingenieur en sewe inspekteurs keur die pype in verskillende stadiums van die vervaardigingsproses en hulle werk skofte om die vervaardigers tegemoet te kom.

Monsters vir kontroletoetsdoeleindes is met verskillende tussenpose geneem en na Pretoria gestuur vir toetsing. Gereelde inspeksies is ook uitgevoer in fabriek in Port Elizabeth, Oos-Londen en Uitenhage waar onder andere pluimveevoer, vloerblokkies, remvloeistof, veiligheidshandskoene, sagte soldeersel en drukkersmetaal, elektriese lampe, breiwol en kouwaterdistemper kragtens die merkskema vervaardig word. Soortgelyke besoeke is ook aan bruisdrankfabriek in Port Elizabeth, Oos-Londen, Queenstown en Middelburg gebring. 'n Inspekteur wat in Oos-Londen gestasioneer is, was verantwoordelik vir gereelde inspeksies in Oos-Londen, Queenstown, Middelburg en Aliwal-Noord terwyl inspeksies in ander sentrums deur die personeel van die kantoor in Port Elizabeth behartig is.

from S.A.B.S. standard specifications and the standardization mark scheme, and owing to this fact many more enquiries were attended to during the past year than during any previous year. There was again a constant demand for S.A.B.S. and British specifications and frequent use was made of the specifications held by this office for reference purposes.

## PORT ELIZABETH OFFICE

New and more spacious premises, adjacent to the former offices were occupied and have made for greater convenience and efficiency.

An increase in the number of requests for all types of tests was evident and amongst the products handled and forwarded to Pretoria for testing were bitumen cork fillers, gold rings, steel wire, reflectors, bricks, sand, cement, building board, cable, barbed wire, steelshafts, motor car batteries, rubber, cast iron, and glue. Calibration of test equipment was carried out in situ as were non-destructive tests on large steel storage bins, steel towbars for trailers and welded joints. Inspections were done on behalf of purchasing organizations on paints, paint brushes, box shooks, preservatives (woolfat compositions), and motor car batteries.

The second stage of the Port Elizabeth Municipal water augmentation scheme, for which the Bureau was appointed to carry out inspections, is now well under way. The Bureau has also been requested to supervise the third stage of the work, which is of the same magnitude as the second stage. The cost of the concrete pipes alone used in the work is estimated at £1,800,000. The City Council of Port Elizabeth views the Bureau's services as a form of insurance on the investment they are making in the manufacture of the pipes. An engineer-in-charge and seven inspectors inspect the pipes at various stages of their manufacture and work shifts to suit the manufacturers.

Samples for control testing purposes were drawn at varying intervals and forwarded to Pretoria for testing. Regular inspections were also undertaken at factories in Port Elizabeth, East London and Uitenhage at which poultry feeds, floor blocks, brake fluid, safety gloves, soft solder and printers' metal, electric lamps, knitting wool and cold water distemper are produced under the mark scheme. Similar visits were also made to mineral water factories in Port Elizabeth, East London, Queenstown and Middelburg. An inspector stationed at East London was responsible for regular inspections in East London, Queenstown, Middelburg and Aliwal North while inspections at other centres in the Port Elizabeth area were carried out by Port Elizabeth office personnel.

During the period under review permits for the use of the mark were granted to manufacturers of mineral



Gedurende die verslagtydperk is permitte vir die gebruik van die merk aan vervaardigers van bruisdranke, verpleegsterskoene, kouwaterdistemper en hout uitgereik. Daar is nou altesaam 32 permithouers binne die gebied wat onder die Port Elizabethse kantoor ressorteer, en die handelsware wat deur hulle vervaardig word, sluit o.a. in houtprodukte, skoëisel en ander leerprodukte, bruisdranke, ingemaakte vrugte en sappe, wolprodukte, metale, pluimveevoer, elektriese lampe, remvloestowwe en ingemaakte vleisprodukte. Tweeweeklikse inspeksies t.o.v. voldoening aan verpligte spesifikasies is by 'n vleisinmaakfabriek in Aliwal-Noord gehou. Agt soorte ingemaakte vleis word tans deur die fabriek in ooreenstemming met vrywillige spesifikasies vervaardig en is reeds die S.A.B.S-merk toegeken. Talryke monsters van ingevoerde ingemaakte vleis en vis is in Port Elizabeth en Oos-Londen geneem en na Pretoria gestuur vir toetsing.

Baie navrae i.v.m. toetsing en standaardspesifikasies is ontvang t.o.v. sederhoutblindings, prentframe, fietsrame, mosaiëkteëls, metale, motorkarsuiers, houtprodukte, huide en velle, kruiwaens, en nylongaring.

Daar is gedurig deur nywerars en ander belanghebbende persone na die S.A.B.S. en B.S.I. se spesifikasies en na die inligtingsblaadjies van die Nasionale Bounavorsingsinstituut verwys. As gevolg van die besoeke wat deur belanghebbende persone by die kantoor in Port Elizabeth afgelê word, verneem die besoekers ook iets oor die Buro se ander dienste. Praatjies oor die dienste deur die Buro gebied, is op uitnodiging voor 'n aantal organisasies uit die gebied gelewer. Party van die plaaslike verenigings het van tyd tot tyd artikels oor die Buro se werksaamhede in hulle publikasies laat verskyn.

Onder die aankooporganisasies wat deur middel van die merkskema van die Buro se toetsdienste gebruik gemaak het, was daar, die Unietenderraad, die Departement Publieke Werke, die Provinsiale Administrasie, skoëiselvevaardigers, plaaslike munisipaliteite, die motornywerheid, die Suid-Afrikaanse Spoorweë en fabrikante van nywerheidsuitrusting. 'n Bestelling vir 45 S.A.B.S.-spesifikasies is van 'n plaaslike hoeveelhedsopnemer ontvang.

Beamptes van die Buro en die Nasionale Fisiese Navorsingslaboratorium het die gebied besoek i.v.m. die nie-vermietigende toetsing van swaar uitrusting en drukketels, die keuring van draad en kables, tekstielware, hout, die kalibrering van toetsapparate, inspeksies voor en na uitreiking van permitte, kongresse, vergaderings van tegniese komitees, ens.; by hierdie besoeke is gebruik gemaak van die geriewe wat deur die kantoor in Port Elizabeth beskikbaar gestel is. Daar is reëlins getref met die Port Elizabethse kantoor sodat die radioisotoopspan iets oor hulle werksaamhede aan belangstellendes in Port Elizabeth en Oos-Londen kon vertel. Die Port Elizabethse kantoor het ook sekretariële werk vir die Middellandse Streeknavorsingskomitee van die W.N.N.R. behartig.

waters, of nurses' shoes, of cold water distemper and of timber. There are now 32 permit holders in the area covered by the Port Elizabeth office and the commodities they produce are timber products, footwear and other leather products, mineral waters, canned fruit and juices, woollen products, metal, poultry feeds, electric lamps, brake fluids, and canned meat products. Fortnightly inspections for compliance with compulsory specifications were made at a meat canning factory situated at Aliwal North. Eight lines of canned meat are now produced at this factory in compliance with voluntary specifications and have been awarded the S.A.B.S. mark. Numerous samples of imported canned meat and canned fish were taken at Port Elizabeth and East London and were forwarded to Pretoria for testing.

Many enquiries about testing and standard specifications were received in connection with cedar wood blinds, picture frames, bicycle frames, mosaic tiling, baked goods, metals, motor car pistons, timber products, hide and skins, wheelbarrows and nylon thread.

S.A.B.S. and B.S.I. specifications and National Building Research Institute information sheets were constantly referred to by industrialists and other interested persons. As a result of visits paid to the Port Elizabeth office by persons interested in these publications, visitors also learn about the Bureau's other services. Talks on the services offered by the Bureau were given on invitation to a number of organizations in this area. A number of local associations have from time to time featured articles on the Bureau's services in their publications.

Purchasing bodies and other organizations which made use of the Bureau through the medium of its mark scheme and test services were, the Union Tender Board, Public Works Department, Provincial Administration, footwear manufacturers, local municipalities, motor industry, South African Railways and manufacturing engineers. An order for 45 S.A.B.S. specifications was received from a local quantity surveyor.

Officers of the Bureau and the National Physical Research Laboratory visited the area in connection with non-destructive testing of heavy equipment and pressure vessels, the inspection of wire and cables, textiles, timber calibration of test equipment, pre- and post-permit inspections, congresses, technical committee meetings; on the occasion of these visits, the facilities provided by the Port Elizabeth office were utilized. Arrangements were made by the Port Elizabeth office for the radioisotope team to explain its services to interested persons in Port Elizabeth and East London. The Port Elizabeth office also carried out secretarial work for the Midland Regional Research Committee, C.S.I.R.



# Nasionale Chemiese Navorsingslaboratorium

*Direkteur:* DR. W. S. RAPSON

Die belangwekkendste kenmerk van die jaar was die snelheid waarmee personeelveranderinge plaasgevind het. Gemiddeld was daar een op elke vyf poste in die Laboratorium gedurende die jaar vakant. Dit op sigself het 'n aansienlike vermindering in die werkverrigting veroorsaak, maar wat miskien nog belangriker as die vakatures self is, was die afname in doeltreffendheid as gevolg van voortdurende personeelveranderinge. Alle Afdelings van die Laboratorium het hieronder gely, maar die uitwerking was op sy ergste in die Afdelings Fisiese, Anorganiese en Analitiese Chemie, waar die werk aan 'n aantal projekte heeltemal tot stilstand gekom het. Dit word steeds moeiliker om personeel wat vir navorsingswerk opgelei is, te werf, sowel in Suid-Afrika as oorses en dit skyn onafwendbaar te wees dat die invloed op die werksaamhede van die Laboratorium steeds ernstiger sal word namate dit ook tot die senior range uitbrei. Dit sal by die beplanning van toekomstige werksaamhede in aanmerking geneem moet word en veral by die aanvaarding van opdrigte van navorsingswerk op 'n kontrakbasis.

Die opdrigte het gedurende die jaar geen vermindering getoon nie, en onder die groter nuwe kontrakte wat gesluit is, kan melding gemaak word van die ooreenkomste met die S.A. Steenkool-, Olie- en Gaskorporasie, S.A. Pulp and Paper Industries Ltd., die Permutit Company (Engeland) en die Stads- en Streeksbeplanningskommissie (Natal) waarvan geldelike steun ontvang word.

Patentaangeleenthede, veral in verband met die ontouting van water, het heelwat van die tyd van die wetenskaplike personeel in beslag geneem, en regverdig noukeurige hersiening van die Raad se bedrywigheid op hierdie gebied.

## MINERAALPRODUKTE

### Kleisoorte

Ten behoeve van 'n nywerheidsfirma is 'n probleem bestudeer in verband met die aanbring van glasuur op 'n keramiekvoorwerp.

'n Onderzoek is kragtens 'n kontrak uitgevoer op 'n kleimonster wat uit 'n uitgestrekte montmorillonietafsetting verkry is. Dit kan as die eerste groot afsetting van „Suid-Afrikaanse bentoniet” beskou word wat geskik is om ingevoerde bentoniet te vervang, bv. as bindklei en gietersand. Na toepaslike behandeling is die klei getoets en het geblyk dat dit vir hierdie doel net so goed as die ingevoerde soorte bentoniet is. Hierdie klei kan ook met 'n suur geaktiveer word, waardeur 'n produk

# National Chemical Research Laboratory

*Director:* DR. W. S. RAPSON

The most significant characteristic of the year's operations was the rapidity with which staff changes occurred. On an average, about one post in five in the Laboratory was vacant during the year. This in itself meant a considerable reduction of activity, but more important perhaps than the vacancies themselves was the great loss in efficiency as a result of continuous staff changes. All Divisions in the Laboratory suffered, but effects were most serious in the Physical, Inorganic and Analytical Chemistry Divisions, where work was brought to a standstill on a number of projects. It is becoming ever more difficult to recruit research trained personnel either from South Africa or from overseas, and it seems inevitable that the effects on the operations of the Laboratory will become increasingly serious as they extend to senior levels. This will have to be taken into account in the planning of future activities and, in particular, in the future acceptance of commitments in respect of research work on a contract basis.

Such commitments continued at a high level during the year, and amongst major new contracts entered into may be mentioned Fellowship Agreements with the S.A. Coal, Oil and Gas Corporation, S.A. Pulp and Paper Industries Ltd., The Permutit Company (Britain), and the Town and Regional Planning Commission (Natal), which support these fellowships financially.

Patent matters, particularly in connection with water desalting, occupied a considerable amount of the time of the scientific staff concerned, and justify a careful review of Council's activities in this field.

## MINERAL PRODUCTS

### Clays

A study was made for an industrial firm on a problem of fitting a glaze to a ceramic body.

A contract investigation was carried out on a clay sample derived from an extensive deposit montmorillonite. This can be regarded as the first large deposit of "South African bentonite" suitable for replacing imported bentonites in uses such as bonding clays in foundry sands. Suitably treated, the clay was tested and found to be equivalent to imported bentonites for this purpose. The clay can also be acid activated to give a product suitable for decolorising oils, and experiments upon this aspect are in progress.



ontstaan wat geskik is om olies te ontkleur; proefnemings in verband hiermee is aan die gang.

Verder is kaolienafsettings ondersoek, veral wat hul mineralogiese samestelling en verbleikingseienskappe betref.

Vir 'n firma wat belang daarin gestel het, is fynkorrelrige vermikuliet afgeskilfer, gemaal en kolloïdaal in 'n smeerolie gedispergeer.

Verskeie monsters klei en grond is vir staatsdepartemente ondersoek om hul mineralogiese samestelling te bepaal.

### Fosfate

Nadat 'n nagraadse beurs beskikbaar gestel is vir bestudering van Phalaborwafosfate, soos reeds in die vorige verslag vermeld, is heelwat werk in verband hiermee gedoen. Dit het hoofsaaklik bestaan in die bestudering van bekende metodes vir die produksie van fosfaat wat in sitroensuur oplosbaar is, met betrekking tot die apatietkonsentraat wat op Phalaborwa geproduseer word. 'n Groot skaalse toets het aan die lig gebring dat smelting met 'n smeltmiddel wat magnesia en silika bevat, gevolg deur blussing, 'n bevredigende produk oplewer. By ondersoek het geblyk dat die produk amorf of glasagtig was en dat dit slegs in hierdie toestand goed oplos. 'n Uitgebreide laboratoriumondersoek is tans aan die gang om te bepaal wat die optimum toestande vir hierdie proses is.

Aangesien die apatiet in Phalaborwakonsentrate van eruptiewe oorsprong is, is dit minder reaktief as fosfate uit Marokko ingevoer. Die verskil in oorsprong veroorsaak ook sekere verskille in die gedrag van konsentrate by die produksie van superfosfaat deur middel van swawelzuurbehandeling. 'n Vergelyking van die gedrag onder verskillende omstandighede is in die Laboratorium uitgevoer, waarby spesiale aandag geskenk is aan die oorsake van die waargenome verskille.

Die omsetting van apatiet in  $\alpha$ -trikalsiumfosfaat wat in sitroensuur oplosbaar is, is ook bestudeer en daar is bewys dat dit ook op Phalaborwakonsentrate van toepassing is. Dit vereis smelting met behulp van 'n smeltmiddel van stoom om die fluoor te verwyder, gevolg deur blussing. Aangesien die proses moeilik is om op groot skaal uit te voer, is sy ekonomiese moontlikhede twyfelagtig.

### Olie uit Steenkool

In die afgelope jaar is daar nie meer so baie nadruk gelê op navorsing in verband met Fischer-Tropsch-katalisators nie, aangesien Sasol beurse beskikbaar gestel het vir die bestudering van hul „Kellogg-katalisator” in die Nasionale Chemiese Navorsingslaboratorium en die Nasionale Fisiese Navorsingslaboratorium. Personeel is aangestel en die aanvanklike doel was om die veranderinge wat tydens gebruik in die katalisator plaasvind, te bestudeer. Dit vereis kwantitatiewe ontleding

Investigations of kaolin deposits were made, especially with respect to mineralogical composition and bleachability.

For an interested firm, fine-grained vermiculite was exfoliated, ground and colloiddally dispersed into a lubricating oil.

Several clay and soil samples were investigated for mineralogical composition on behalf of government departments.

### Phosphates

Following the institution of a Fellowship for study of Phalaborwa phosphates, as stated in the previous report, a considerable amount of work has been carried out. This was primarily concerned with the study of already known methods of producing citric acid soluble phosphate in relation to the apatite concentrate produced at Phalaborwa. A large scale test showed that fusion with a flux containing magnesia and silica, followed by quenching, gave a satisfactory product. A study of the product showed that it was amorphous or glassy and that it only possessed good solubility in this state. A detailed laboratory study is therefore under way to find out the optimum conditions for this process.

The apatite in Phalaborwa concentrates being of igneous origin is less reactive than imported Moroccan phosphates. The difference in origin also gives rise to certain differences in the behaviour of concentrates in production of superphosphate by sulphuric acid treatment. A comparison of the behaviour under a variety of conditions was carried out in the Laboratory, with particular stress on the causes of observed differences.

The conversion of apatite to citric acid soluble  $\alpha$ -tricalcium phosphate was also studied and was shown to be applicable to Phalaborwa concentrates. This requires fusion with help of a flux in presence of steam to remove fluorine, followed by quenching. As the process is difficult to carry out on a large scale its economic possibilities are doubtful.

### Oil from Coal

In the past year, research on Fischer-Tropsch catalysts have changed in emphasis, since Fellowships have been set up by Sasol to carry out studies on their “Kellogg catalyst” in the National Chemical Research Laboratory and the National Physical Research Laboratory. Staff was appointed and the initial objective was to study the changes which take place in the catalyst during its use. This requires quantitative analysis of the catalyst for free iron, iron carbides, iron oxides, free carbon and



van die katalisator vir ongebonde yster, ysterkarbiede, ysteroksiede, ongebonde koolstof en was wat normaalweg daarin aanwesig is, en aangesien daar tot nog toe nie in geslaag is om dit op chemiese wyse te doen nie, moet toevlug tot fisiese metodes geneem word, soos, bv. X-straaldiffraksie en gebruikmaking van 'n magnetiese ringskoëffisiënt. Bereiding van suiwer verwysingsverbindings is noodsaaklik en daar word hard in hierdie rigting gewerk.

'n Voorafgaande studie van die chemisorpsie-eienskappe van katalisators is gemaak, maar dit het ondoenlik geblyk om die laaste spore van organiese stowwe deur ekstraksie met organiese oplosmiddels van katalisatorvlakke te verwyder, waarskynlik omdat sulke stowwe baie sterk gepolimeriseer is. Daardeur is dit onmoontlik om 'n vlak skoon genoeg vir chemisorpsiewerk te maak en metings het inderdaad aan die lig gebring dat reproduseerbaarheid volkome onmoontlik is. Dit is duidelik dat sulke metings tot ongebruikte katalisators beperk moet bly, en by voorkeur tot die suiwer bestanddele wanneer hulle beskikbaar word.

Tot nog toe was die vernaamste moeilikheid wat hom by die bestudering van die outo-oksidasie van koolwaterstofverbindings voorgedoen het, die ontleding van die komplekse reaksiemengsels wat verkry is. By die huidige bestudering van die outo-oksidasie van die Fischer-Tropsch-modelkoolwaterstofverbinding, 5-metielnonaan, is ontleding van die reaksiemengsels geslaag deur die betreklik nuwe gaschromatografiese metode te volg. Deur die afgelope jaar se werk is die hooftrekke van hierdie bepaalde reaksie vasgestel.

## DIERLIKE PRODUKTE

### Wol

Net soos in die voorafgaande jare is hierdie werk met 'n toekenning van die Wolraad gedoen. Die werk het grotendeels bestaan in die voortgesette bestudering van die veranderlikheid wat onder merinovagte aangetref word met spesiale verwysing na die veranderings deur 'n kopertekort veroorsaak. By 'n poging om meer omtrent die molekulêre struktuur van wol te wete te kom, is gebruik gemaak van die afbraak van die vesels deur middel van proteolitiese ensieme. Vergelyking van die afbraakprodukte van verskillende wolsoorte behoort te help om die fundamentele verskille tussen hulle aan die lig te bring. Derhalwe is die werking van tripsien op wol bestudeer, en die residu van die N-terminale aminosure van die aldus vrygestelde peptiede is bepaal. Die Afdeling is besig met die elektroforetiese en chromatografiese skeiding van hierdie peptiede. Weens die verbasend ingewikkelde samestelling van wol moet hierdie proefnemings as voorlopig beskou word; tog wys die resultate wat tot nog toe verkry is, daarop dat daar geen verskil tussen die eienskappe van die mengsel verkry na vertering

waxes which are normally present in it; and since chemical methods have thus far failed to do this, reliance must be placed upon physical methods such as X-ray diffraction and magnetic susceptibility. Preparation of pure reference compounds is a necessity and much effort is being directed along these lines.

A preliminary study of the chemisorption properties of catalysts was made, but it proved impossible to remove last traces of organic matter from used catalyst surfaces by any process of extraction with organic solvents, probably because such matter is very highly polymerised. This makes it impossible to prepare a surface clean enough for chemisorption work, and measurements showed, in fact, that reproducibility was completely impossible. It is clear that such measurements must be restricted to unused catalysts, and preferably, to the pure components when these become available.

Until now the chief difficulty encountered in the study of the autoxidation of hydrocarbons has been the analysis of the complex reaction mixtures obtained. In the current studies of the autoxidation of the model Fischer-Tropsch hydrocarbon, 5-methyl nonane, the analysis of the reaction mixtures was successfully accomplished by the relatively new technique of gas chromatography. The past year's work established the main features of this particular reaction.

## ANIMAL PRODUCTS

### Wol

As in previous years, this work was carried out under a Fellowship supported by the Wool Board. Work was devoted largely to the continuation of a study of variability amongst merino fleeces with special reference to variations caused by deficiency of copper. In an attempt to learn more about the molecular structure of wool, use has been made of the degradation of the fibres by means of proteolytic enzymes. A comparison of the products of degradation from different wools should help to reveal fundamental differences between them. A study was therefore made of the action of trypsin on wool and the N-terminal amino-acid residues of the peptides liberated in this way were estimated. Work on the electrophoretic and chromatographic separation of these peptides is in progress. Because of the great complexity of wool these experiments must be regarded as preliminary. Nevertheless, it is apparent from the results obtained so far that there are no great differences between normal and copper deficient wools in the properties of their tryptic digests.

An investigation of some importance into the action



met tripsien van normale wol en dié van wol met 'n kopertekort is nie.

Daar is 'n begin met 'n taamlik belangrike ondersoek in verband met die werking van lig op dinitrofenielaminosure gemaak. Hierdie derivate word baie vir endgroep-ondersoek van wol en ander proteïene gebruik.

'n Studie van die reaksies van die disulfiedbinding in wol het 'n aanvang geneem. Hierdie bindings is verantwoordelik vir baie van wol se welbekende eienskappe, soos karteling en buigbaarheid, en wanneer wol verweer is, is dit hulle wat vernameelik aangetas word en verlies van buigbaarheid veroorsaak. Die chemiese aard van hierdie veranderinge is nog nie heeltemal goed bekend nie. As daar helderheid omtrent sou bestaan, sou dit miskien moontlik wees om die vesel so te verander dat hy sulke veranderinge sou kan weerstaan.

Die navorsing in verband met die samestelling van wol was is aan die begin van die jaar voltooi.

#### **Die Lipoproteïene in Eiergeel**

As houer van 'n navorsingsbeurs in Kanada het een van die senior lede van die personeel daarin geslaag om party van die lipoproteïene in eiergeel af te sonder en te identifiseer. Ook was dit moontlik om party van die komplekse onderlinge reaksies van hierdie bestanddele te bestudeer.

#### **Onversadigde Sure**

Werk in verband met die onversadigde sure in visolies waaromtrent in vorige jare verslag gedoen is, het aan die lig gebring dat vir die voortsetting van sulke werk 'n ultramikrometode vir die ontleding van mengsels van hierdie sure 'n dringende vereiste is. Daar is 'n begin met die werk in verband met hierdie projek gemaak en daar is reeds enkele veelbelowende resultate bereik.

### **PLANTAARDIGE PRODUKTE**

#### **Vlugtige Olies**

Die Afdeling Tuinbou en Plantkunde van die Landboudepartement het voortgegaan om medewerking in verband hiermee te verleen, en verskeie oliesoorte gedistilleer uit plante wat onder beheerde toestande in Pretoria gekweek is, is versamel en ontleed. Baie monsters inheemse hout deur die Bosnavorsingsinstituut van die Bosboudepartement is ondersoek om vas te stel of hul vlugtige olies bevat. 'n Monografie oor die inheemse plante in Suid-Afrika wat vlugtige olies bevat, is in voorbereiding.

#### **Ondersoek in verband met Giftige Plante**

„Geeldikkopsiekte”

Die Afdeling Veeartsenydiens (Onderstepoort) van die Landboudepartement het nog steeds aktiewe medewerking in verband met hierdie projek gelewer. Die Onderstepoortgroep het gedurende die jaar heelwat

of light on dinitrophenyl amino acids was started. These derivatives are much used for end-group studies on wool and other proteins.

A study of the reactions of the disulphide linkage in wool was initiated. These linkages are responsible for many of wool's well known characteristics, such as crimping and resilience, and when wool weathers they are the ones mainly affected causing loss of resilience. The chemical nature of these changes is only incompletely understood. Better understanding might enable modification of the fibre to resist these changes.

Studies on the composition of wool wax were concluded during the early part of this year.

#### **Egg Yolk Proteins**

During tenure of a Research Fellowship in Canada, one of the senior members of the staff was able to separate and characterize some of the major lipo-proteins in egg yolk. It was also possible to study some of the complex interactions of these constituents.

#### **Unsaturated Acids**

Work on the unsaturated acids of fish oils, reported in previous years, indicated that for the further development of such work an ultra-micro method for the analysis of mixtures of these acids was essential. Work was started on this project and some promising results were achieved.

### **PLANT PRODUCTS**

#### **Essential Oils**

Co-operation with the Divisions of Botany and Horticulture of the Department of Agriculture continued, and several oils distilled from plants grown under controlled conditions in Pretoria were collected and analysed. Many samples of indigenous woods supplied by the Forest Research Institute of the Department of Forestry were screened for essential oils. A monograph on the indigenous essential oil bearing plants of South Africa is in preparation.

#### **Investigation of Poisonous Plants**

„Geeldikkop”

Active co-operation with the Division of Veterinary Services (Onderstepoort) of the Department of Agriculture continued. During the year, the Onderstepoort group made considerable progress in the study of the



vordering gemaak met hul navorsing in verband met die chemiese patologie van die siekte by skape. Hierdie werk het die regte biologiese hulpmiddel verskaf wat nodig is vir die beoordeling van die giftige bestanddele in die plant. Die groep skeikundiges het hulself hoofsaaklik besig gehou met die afsondering en die vasstelling van kenmerke van die sapogeniene wat deur middel van hidrolise uit die saponiene van *Tribulus terrestris* afgesonder is. Hulle is almal afgesonder en geïdentifiseer.

Daar is reeds by 'n vorige geleentheid verslag omtrent die labiele geaardheid van die saponien gedoen wat vermoedelik die giftige bestanddeel in die plant is. Daar is nooit in geslaag om hierdie saponien uit plantemateriaal uit die Karoo afkomstig en nie vars nie, af te sonder. Die probleem is opgelos deur vars materiaal in die veld te ekstraheer in 'n mobiele laboratorium gebou met geld wat welwillend deur die Veeskienavorsingsfonds geskenk is. Hierdie eenheid het een proef tydperk in die Karoo deurgebring, waartydens 'n groot hoeveelheid aktiewe saponien uit vars plantemateriaal geëkstraheer is.

#### „Vermeersiekte”

Hierdie projek word op dieselfde grondslag van samewerking as in die geval van „geeldikkop” behandel. Die kenmerke van geigerinien wat uit *Geigeria aspera* afgesonder is, is gedeeltelik vasgestel. Bowendien is verskeie ander verbindings in 'n suiwer staat uit die ekstrak afgesonder. Die skeiding van die bestanddele van die ekstrak van die *Geigeria africana* was tot nog toe 'n buitengewoon moeilike taak. 'n Oplossing van die probleem skyn egter moontlik te wees.

#### Bitter Bestanddele van die Cucurbitaceae

Die samewerking by hierdie projek van die Afdeling Tuinbou en Plantkunde van die Landboudepartement ontvang, het goeie vrugte afgewerp. Die metodes vir die afsondering van hierdie stowwe ontwikkel, was van groot nut by genetiese ondersoeke. Die werk het internasionale erkenning ontvang wat blyk uit die feit dat een van die betrokke beamptes versoek is om 'n verhandeling te lewer tydens die simposium van die Linnaeusvereniging in Londen wat gedurende die jaar gehou is.

#### Ensieme van die Cucurbitaceae

##### *Elaterase*

'n Metode vir die kolorimetriese bepaling van hierdie ensiem, gebaseer op die hidrolise van *o*-nitrofeniel- $\beta$ -*d*-glukosied, is uitgewerk. Hierdie metode is vinniger en gevoeliger as die metode wat voorheen gebruik is met elaterinied as substratum. Werk in verband met die suiwering van die ensiem is voortgesit.

##### *Asetielesterase*

Werk deur die Afdeling Tuinbou van die Landboudepartement gedoen, het aan die lig gebring dat die vrugte van Cucurbitaceae 'n aantal ensieme bevat wat

chemical pathology of the disease in sheep. This work has provided the precise biological tool necessary for evaluating the toxic principles of the plant. The chemical team concerned itself mainly with the isolation and characterization of the sapogenins isolated from the saponins of *Tribulus terrestris* by hydrolysis. All of these were isolated and identified.

The labile nature of the saponin thought to be the toxic principle in the plant has been reported on previously. This saponin could never be isolated from plant material sent from the Karoo, which was not fresh. The problem was solved by extracting fresh material in the field in a mobile laboratory, built by funds generously donated by the Stock Diseases Research Fund. This unit spent one trial period in the Karoo during which active saponin was extracted from fresh plant material in quantity.

#### “Vermeersiekte”

This project is on the same collaborative basis as that of “geeldikkop”. The geigerinin isolated from *Geigeria aspera* was partially characterized. Apart from this result several other compounds were isolated from the extract in a state of purity. The separation of the components of the *Geigeria africana* extract has proved extremely difficult up to now. However, a solution to this problem appears feasible.

#### Bitter Principles of the Cucurbitaceae

The collaboration received on this project from the Divisions of Botany and Horticulture of the Department of Agriculture was very fruitful. The methods developed for the separation of these substances were very valuable in the genetic studies. The work received international recognition as proved by the fact that one of the officers concerned was invited to present a paper at a symposium of the Linnaean Society in London during the year.

#### Enzymes of the Cucurbitaceae

##### *Elaterase*

A colorimetric method of assay based on the hydrolysis of *o*-nitrophenyl- $\beta$ -*d*-glucoside was developed. This is quicker and more sensitive than the previous method using elaterinide as substrate. Work on the purification of the enzyme was continued.

##### *Acetylestherase*

Work carried out by the Division of Horticulture of the Department of Agriculture has shown that the fruits of the Cucurbitaceae contain a number of enzymes which

verskillende bitter bestanddele in ander lede van die reeks kan omsit. Een van hierdie ensieme skyn 'n asetielesterase te wees. 'n Vinnige kolorimetrieëse metode vir die bepaling van hierdie ensiem is ontwikkel. Werk in verband met die suiwering van die ensiem en die bestudering van sy eienskappe duur voort.

#### *Seegrasse*

Daar is bewys dat die polisakkaried uit die seegras *Hypnea specifera* afgesonder baie eienskappe met die polisakkaried carrageenien uit *Chondrus crispus* gemeen het. Die hoofkenmerke van die molekuleêre struktuur van die polisakkaried is uitgewerk en die werk in verband met die probleem is afgehandel. Carrageenien word baie in die farmaseutiese en die lekkergoedbedryf gebruik.

#### **Wattelhout**

Die ondersoek in verband met die struktuur van die xilaanbestanddeel, een van die hemiselluloses van wattelhout, het klaar gekom, en vorm 'n bydrae tot ons basiese kennis van hierdie belangrike grondstof.

Die werk wat met geldelike steun van die Wattelkwekersunie onderneem is, was van tegnologiese aard. 'n Uitgebreide ondersoek in verband met die vervaardiging van grysbord uit wattelspaanders is gedoen. Gedurende hierdie werk is 'n formulering vir 'n kleefmiddel vir grysbord op watteltannien gebaseer, uitgewerk. Die werk is afgehandel en 'n verslag sal gepubliseer word.

#### **Houtpapondersoek**

Daar is gedurende die jaar 'n begin gemaak op die basis van 'n langtermynkontrak met die ondersoek van die geskiktheid van hier te lande gekweekte hout vir die bereiding van houtpap. Die bereiding van houtpap vir sowel papier- as rayonvervaardiging is aan die toeneem in die Unie, en fabrikante voel behoefte aan meer fundamentele inligting omtrent hul grondstowwe. Die Departement Bosbou is behulpsaam met die voorsiening van materiaal vir die proefnemings, en na verwagting sal die projek van nut wees by die bepaling van die toekomstige boomplantbeleid en aanplantmetodes om in die behoeftes van die houtpapywerheid te voorsien.

#### **Kafferkoring**

Hierdie ondersoek is weer eens ondersteun deur 'n beurstoekening van die Instituut van Administrateurs van Nie-blanke Aangeleenthede.

Moutingstoetse is op 'n aantal monsters van verskillende soorte kafferkoring gedoen. Die werk word met die medewerking van die Potchefstroomse Landboukollege gedoen en vorm deel van 'n langtermynondersoek van die moutingseienskappe van die belangrikste kafferkoringsoorte en die invloed van seisoens- en klimaats-toestande op hulle. 'n Interessante bevinding was dat monsters Martinkafferkoring van die 1957-oes moute

are capable of converting various bitter principles into other members of the series. One of these enzymes appears to be an acetylesterase. A rapid colorimetric method of assay for the enzyme was developed. Work on the purification of the enzyme and the study of its properties is in progress.

#### *Seaweeds*

It was demonstrated that the polysaccharide isolated from the seaweed *Hypnea specifera* has many features in common with the polysaccharide carrageenin from *Chondrus crispus*. The main features of the molecular structure of the polysaccharide were worked out and work on the problem was concluded. Carrageenin has many applications in the pharmaceutical and confectionary trades.

#### **Wattle Wood**

The structural work on the xylan component, one of the hemicelluloses of wattle wood was completed, and so forms a contribution to our basic knowledge of this important raw material.

The work supported by the Wattle Growers' Union Fellowship was of a technological nature. An extensive investigation into the production of a particle board from wattle chips was carried out. During this work a formulation for a particle board adhesive based on wattle tannin was evolved. The work was completed and a report will be published.

#### **Wood Pulping Studies**

An investigation of the pulping qualities of locally grown timber was initiated on a long-term contract basis during the year. Wood pulping for both paper and rayon production is increasing in the Union, and manufacturers are feeling the need for more fundamental information about their raw materials. The Department of Forestry is assisting by supplying material for trials, and it is expected that the project will be of assistance in determining future planting policy and plantation practice to serve the needs of the pulping industry.

#### **Kaffircorn**

This work was again supported by a Fellowship from the Institute of Administrators of Non-European Affairs.

Malting tests were carried out on a number of samples of different varieties of kaffircorn. This work is being done in collaboration with the Potchefstroom Agricultural College and is part of a long-term study of the malting qualities of the most important varieties of kaffircorn and the influence of seasonal and climatic conditions on them. An interesting finding was that samples of Martin kaffircorn of the 1957 crop gave malts



opgelewer het met van die hoogste diastatiese vermoëns wat nog ooit in die laboratorium verkry is. Dit vorm 'n skerp teenstelling met die slegte resultate wat in 1956 met hierdie selfde soort verkry is, en bewys dat dit nodig is om 'n soort gedurende meer as een seisoen te bestudeer ten einde 'n betroubare bepaling van sy moutingseienskappe te kry. Onder die ander graansoorte wat ondersoek is, was daar 'n nuwe met die naam van Framida. Hierdie soort het baie voortreflike agronomiese eienskappe maar die Landboudepartement wil graag vasstel of dit 'n kafferkoring met goeie moutingseienskappe is, alvorens hulle boere aanmoedig om dit te kweek.

Die amilases van mout uit die voëlproef-kafferkoringsoort gemaak verskil van dié van moute van die meeste ander soorte gemaak, deurdat hulle grotendeels onoplosbaar in water is. Hulle is egter in 'n aktiewe vorm in die mout aanwesig. Hulle kan in meerdere of mindere mate geëkstraheer word deur oplossings van 'n verskeidenheid verbindings, met inbegrip van 10-persentige natriumchloried, nie-ioniese reinigingsmiddels van die poliëtileenoksiedestertipe, verskillende aminosure en stikstofhoudende verbindings. Die doeltreffendste ekstraheermiddels is peptoon en sekere basiese verbindings wat 'n N-C-N-groepering bevat. Moute van Framida en soetriet bevat ook 'n sekere hoeveelheid onoplosbare amilases, hoewel minder as dié van die voëlproefvariëteit. Die amilases van alle ander soorte kafferkoringmout wat tot nog toe ondersoek is, is volkome oplosbaar in water.

Aangesien die gebruikelike metode vir die bepaling van die diastatiese vermoë van mout gebaseer is op die ekstraksie van die amilases met water, is hy nie geskik vir moute wat onoplosbare amilases bevat nie. Verskillende ander metodes is ondersoek. Daar is bevind dat ekstraksie van voëlproef-moute met 'n 1-persentige peptoonoplossing diastatiese waardes oplewer wat goed ooreenstem met hul vermoë om 'n beslag te verdun en te versuiker by die toestand waarby gebrou word. In die geval van moutsoorte wat oplosbare amilases bevat, word met hierdie metode dieselfde diastatiese waarde verkry as met die normale waterekstrasie metode. Peptoon-ekstraksie is derhalwe deur die Buro vir Standaard aanvaar as basis vir 'n standaardmetode vir bepaling van die diastatiese vermoë van alle kafferkoringmoutsoorte.

Die belangrikste werk wat gedurende die jaar klaar gekom het, was die laboratoriumondersoek van die rol wat mout by die afbraak van stysel gedurende die brou van kafferbier speel. By hierdie werk het geblyk dat die brouerye hul mout nie op sy voordeligste gebruik nie. In die meeste gevalle word 'n baie groter verhouding van mout tot graan gebruik as wat nodig is. Bowendien word die mout by die huidige broustelsel wat op tradisionele Bantoemetodes gebaseer is, by 'n baie ongunstige pH gebruik. 'n Alternatiewe broumetode is aan die hand gedoen om dit te voorkom. Grootskaalse brou-toets

with some of the highest diastatic powers ever obtained in the laboratory. This contrasts with the poor results obtained with this variety in 1956, and shows the need for studying a variety over a number of seasons in order to get a proper assessment of its malting qualities. Amongst the other grains studied was a new variety, Framida. This has many desirable agronomic qualities but the Department of Agriculture wishes to determine whether it is a good malting kaffircorn before encouraging farmers to grow it.

The amylases of malt made from the birdproof variety of kaffircorn differ from those of malts from most other varieties in that they are largely insoluble in water. They are nevertheless present in the malt in an active form. They may be extracted to a greater or lesser extent by solutions of a variety of compounds including 10 per cent sodium chloride, non-ionic detergents of the polyethylene oxide ester type, various amino acids and nitrogenous compounds. The most effective extractants are peptone and certain basic compounds containing an N-C-N grouping. Framida and Sweet Sorgho malts also contain a certain proportion of insoluble amylases though this is less than in the case of birdproof. The amylases of all other varieties of kaffircorn malt examined to date are fully soluble in water.

Since the normal method of determining the diastatic power of malt depends on the extraction of the amylases with water, it is not suitable for malts containing insoluble amylases. Various alternative methods were investigated. It was found that extraction of birdproof malts with 1 per cent peptone solution gives diastatic values which are in good agreement with their ability to thin and saccharify a mash under the conditions used in brewing. With malts containing soluble amylases this method gives the same diastatic value as the normal aqueous extraction method. Peptone extraction has therefore been adopted by the Bureau of Standards as the basis of a standard method for determining the diastatic power of all types of kaffircorn malts.

The most important work completed during the year was the laboratory study of the role of malt in the breakdown of starch during the brewing of kaffir beer. The work showed that the breweries do not use their malt to the best advantage. In most cases a far greater proportion of malt to grain is used than is necessary. Moreover, in the present system of brewing, based on traditional Bantu methods, the malt is used at a very unfavourable pH. An alternative method of brewing has been proposed to obviate this. Large scale brewing tests are at present

word op die oomblik gedoen in samewerking met die Pretoriase Munisipale Brouery om die resultate van die laboratoriumtoetse in die praktyk op die proef te stel. Daar word geskat dat die nywerheid deur meer doeltreffende gebruik van kafferkoringmout as gevolg van verbeterings in broumetode op hierdie werk gebaseer, jaarliks meer as £100,000 op grondstowwe alleen sou kan bespaar, terwyl die kwaliteit van die bier ook tegelykertyd verbeter kan word.

'n Reeks grootskaalse broutoetse is gedoen om die mate van geskiktheid van verskillende soorte mielieprodukte te bepaal as byvoegmiddels wanneer kafferbier gebrou word. Dit het geblyk dat wanneer 'n groot hoeveelheid mielies gebruik word, die beste resultate met produkte van mielies waarvan die kiem verwyder is, verkry word. Ongesifte nie-gegranuleerde mieliemeel en kiemmeel lewer minderwaardige bier op.

Goeie vordering is geboekstaaf in verband met die toets van verskillende soorte masjiene om kafferbier af te meet, asook met die ontwerp van 'n masjien om plastiekbierbekers te was.

Advies in verband met probleme met betrekking tot verwerking en uitrusting is aan 'n aantal munisipaliteite en mouters wat geldelike steun vir die projek verleen, gegee.

#### **Stokroos (*Hibiscus cannabinus*)**

Die ondersoek na die invloed van die variëteit op die veselopbrengs is in samewerking met die Afdeling Akkerbou en Weiding van die Landboudepartement voortgesit.

## **MEDIESE BIOCHEMIE**

### **Vitamien-A-stofwisseling**

Die werk in verband met die assosiasie tussen vitamien A en rotserumproteïene is voortgesit. Die invloed van die kompleksvormende boraatbuffer op die glikoproteïene en die proteïene-vitamien-A-kompleks is ondersoek. Verdere proewe is gedoen om die absorpsie van vitamien A in die geval van rotte te bepaal, asook die aard van die stofwisselings- of ontbindingsprodukt van vitamien A wat in die bloed gevind is. Die tegniek vir die meting van absorpsiespektra van die gepolariseerde toestande van vitamien A en verwante verbindings met die registrerende Beckman D.K.1 spektrofotometer is uitgewerk. Hierdie instrument kan nou by die identifisering van die stofwisselingsprodukte van vitamien A gebruik word.

### **Lipoproteïene by Aterosklerose**

Die werk wat in samewerking met die Suid-Afrikaanse Instituut vir Mediese Navorsing gedoen word, is voortgesit. Weens die afwesigheid van die betrokke senior beampte in die buiteland, was die hoofdoel gedurende die verslagjaar om monsters onder die Bantoe- en die blanke

being carried out in collaboration with the Pretoria Municipal Brewery to test the results of the laboratory experiments under practical conditions. It is calculated that more efficient use of kaffircorn malt resulting from improvements in brewing practice based on this work could save the industry more than £100,000 yearly on raw materials alone, at the same time improving the quality of the beer.

A series of large scale brewing tests was carried out to determine the suitability of different types of mealie products as adjuncts in the brewing of kaffir beer. It was shown that when a large proportion of mealies is used the best results are obtained with degermed mealie products. Straight run mealie meal and germ meal give inferior beers.

Good progress was made with the testing of various types of machines for metering kaffir beer, as also with the development of a machine for washing plastic beer mugs.

Advice on individual problems of processing and equipment was given to a number of municipalities and maltsters who are contributors to the Fellowship.

#### **Kenaf ("Stokroos", *Hibiscus cannabinus*)**

The study of the effect of variety on the yield of fibre was continued in collaboration with the Division of Crops and Pastures of the Department of Agriculture.

## **MEDICAL BIOCHEMISTRY**

### **The Metabolism of Vitamin A**

The work on the association of vitamin A with rat serum proteins was continued. The influence of the complexing borate buffer on the glycoproteins and the protein-vitamin A complex was investigated. Further experiments were conducted to determine the absorption of vitamin A in the rat, and the nature of the metabolic or decomposition product of vitamin A which was detected in the blood. The technique for measuring the absorption spectra of the polarised states of vitamin A and related compounds with the recording Beckman D.K.1 spectrophotometer was elaborated. This instrument can now be applied in the identification of metabolic products of vitamin A.

### **Lipoproteins in Atherosclerosis**

The collaborative project with the Medical Research Institute was continued from the previous year. Owing to the absence overseas of the senior officer concerned, the primary objective during the period under review was collection and examination of samples from both Bantu

bevolking te versamel en te ondersoek. Onlangs is die resultate toe statisties ontleed en hoewel hierdie resultate daarop wys dat daar nog 'n taamlike aantal monsters bestudeer moet word om die werk af te rond, is dit reeds baie duidelik dat die lipoproteïenepeil by blanke proefpersone baie hoër is as by vergelykbare Bantoe proefpersone. Dit geld veral vir die lipoproteïenfraksie met die stadigste flotasietyempo in die ultrasentrifuge. Die Gofmanmetode is dwarsdeur die werk gebruik.

#### Die Chemiese Meganisme van Kankerverwekking

Hierdie werk word nog steeds deur die Nasionale Kankervereniging gefinansier en in samewerking met die W.N.N.R. se Voedingnavorsingseenheid aan die Universiteit van die Witwatersrand uitgevoer. Die ondersoek van velkankerverwekking is voortgesit en sekere chemiese verskille tussen rotvel en muisvel is opgemerk. Van hierdie verskille is gebruik gemaak om nuwe toetse te ontwerp waarby getrag word om die gewone vatbaarheid van muis vir velkankerverwekking te verander.

Tegelykertyd is begin met 'n ondersoek in verband met die chemiese meganisme van die ontstaan van kanker in die lever van rotte wat op asokleurstowwe gevoer word. Daar word getrag om verbindings van hierdie kleurstowwe wat gedurende die vroeë stadia van die metabolisme gevorm word, af te sonder.

'n Studie van die uitwerking van herhaalde inspuittings van tripaanblou op die serumproteïene van rotte is voltooi. Geen belangrike verandering in die elektroforetiese patroon is gewaar tot na die 22ste week van behandeling toe party van die rotte gewasse begin kry het. Die beelde by hierdie diere het ooreengestem met dié in die sera van rotte waarby die galbuis afgebind was en met dié wat in die literatuur vir sekere soorte lewerbeskadiging aangegee word. Dit is dus wel moontlik dat die veranderinge in serumproteïene wat na herhaalde inspuiting met tripaanblou gevind is, die gevolg is van beskadiging van die lewer of belemmering van die galvloei, eerder as die gevolg van primêre werking van die kleurstof op die bloedproteïene self.

Daar bestaan 'n teorie dat die binding van asokleurstowwe aan proteïene die relatiewe stabiliteit van hulle cis-transomere kan beïnvloed en dat die op sy beurt weer die kankerverwekkingsvermoë van die kleurstof kan affekteer. Die stabiliteit van die cisvorm van verskillende kleurstowwe word in aanwesigheid en afwesigheid van proteïene bepaal deur die fototropiese uitwerking te meet ten einde vas te stel of dit met die kankerverwekkingsvermoë van die kleurstof in verband gebring kan word.

### MIKROBIOLOGIESE CHEMIE

#### Wynnavorsing

'n Navorsingseenheid vir die Wynnywerheid is op Stellenbosch in die lewe geroep. Die eenheid is in een van die geboue waar die Vrugtenavorsingstasie van die Westelike Provinsie tans gehuisves is, onder-

and European populations. Recently, a statistical analysis was made of the results, and, while these show that a moderate number of samples must still be studied to round off the work, the conclusion is quite definitely apparent that the lipoprotein level in European subjects is much higher than in comparable Bantu subjects. This is particularly true for the lipoprotein fraction with the slowest flotation rate in the ultracentrifuge. The Gofman procedure was adhered to throughout the work.

#### The Chemical Mechanism of Carcinogenesis

This work continues to receive the support of the National Cancer Association and is carried out in collaboration with the C.S.I.R. Nutrition Research Unit at the University of the Witwatersrand. The investigation of skin carcinogenesis was continued and certain chemical differences between rat and mouse skin noted. These differences were used to devise new tests in which attempts are being made to modify the ordinary susceptibility of mice to skin carcinogenesis.

A parallel investigation was started on the chemical mechanism of cancer development in the livers of rats fed with azo dyes. Attempts are being made to isolate the compounds formed in the liver during the early stages of the metabolism of these dyes.

The study of the effects of repeated injections of Trypan Blue on the serum proteins of rats was completed. No significant change in electrophoretic pattern was detected until after the twenty-second week of treatment when some of the rats began to develop tumours. The pictures found in these animals were similar to those in the sera of rats where the bile duct had been ligatured and to those reported in the literature of various types of liver damage. It is therefore possible that the changes in serum proteins found after repeated injections of Trypan Blue are the result of damage to the liver or obstruction of the bile flow, rather than the result of primary action of the dye on the blood proteins themselves.

A theory has been put forward that the binding of azo dyes to proteins may affect the relative stability of their cis-trans isomers and that this in turn may influence their carcinogenicity. The stability of the cis form of various dyes is being determined in the presence and absence of protein by measuring the phototropic effect to discover whether this can be related to the carcinogenicity of the dye.

### MIKROBIOLOGICAL CHEMISTRY

#### Wine Research

A Wine Industries Research Unit has been established at Stellenbosch. The Unit is housed in one of the buildings at present occupied by the Western Province Fruit Research Station and it is working in close co-operation



gebring, en tree in noue samewerking met die Enologiese Navorsingsinstituut van die Landboudepartement op wat uiteindelik in dieselfde gebou gehuisves gaan word. Voordat die beampte aan die hoof van die Eenheid na Stellenbosch gegaan het, het hy 'n reis van vier maande deur Europa en Kalifornië gemaak om hom op hoogte van die jongste ontwikkelings in verband met navorsing met betrekking tot die mikrobiologie van wynmakery te stel.

Die Eenheid het begin om die oorsake van biotiese troebelheid in Suid-Afrikaanse wyne te ondersoek. Dit vorm 'n baie ernstige probleem in hierdie nywerheid. 'n Groot aantal aangetaste wyne is ondersoek en die giste daarin bevat, is afgesonder en geïdentifiseer. Baie belangrike resultate is reeds verkry. Daar is bevind dat ongeveer 50 persent van die afgesonderde giste tot die genus *Brettanomyces* behoort. Hierdie verhouding is baie groter as dié in die geval van Franse wyne gerapporteer waar die syfer ongeveer 1 persent was. Tans word die metabolisme van hierdie gissoorte bestudeer om te probeer vasstel waarom hulle so baie in plaaslike troebel wyne voorkom en ook om te trag om metodes te vind om hul ontwikkeling teë te gaan.

Werk wat oorsee gedoen is, het aan die lig gebring dat die boeket van wyn en brandewyn baie beïnvloed kan word deur die gissoort wat vir fermentering gebruik word. Ook is aangetoon dat die natuurlike gisflora op die druiwe heelwat kan verskil op verskillende plekke. Daar word dus nou 'n studie gemaak van die gisflora van die druiweboorde en wynkelders in verskillende dele van die Kaapprovinsie om te probeer om hulle met die aard van die wyn in daardie gebiede geproduseer, te korreleer.

#### Vertering en Metabolisme by die Herkouer

Hierdie werk word in samewerking met die Veeartsenykundige Navorsingslaboratorium op Onderstepoort gedoen.

#### *Die invloed van koolhidrate op ureumverbruik*

Die aantal bakterieë wat tot die verskillende metabolismegroepe behoort, in die grootpens van die skaap wat op verskillende diëte gevoer is, is getel. Dit het geblyk dat by verandering van die dieet van glukose-ureum-hooi tot stysel-ureum-hooi tot 'n twintigvoudige vermeerdering in die aantal selluloseverterende bakterieë en 'n sesvoudige vermeerdering in die aantal bakterieë wat melksuur gebruik, gelei het. Kleiner verskille is gevind in die aantal organismes wat stysel, glukose en xilose verbruik. Hierdie veranderinge in die flora in die grootpens sou een van die faktors kan wees waarom diere gewoonlik beter op ureum reageer, wanneer stysel as koolhidraatbyvoegsel gevoer word as wanneer melasse gevoer word, aangesien die aantal selluloseverterende bakterieë die diere in staat sou stel om beter gebruik van die hooi in die dieet te maak, terwyl die toename in die melksuurverbruikende bakterieë, wat aktief vitamien B<sub>12</sub> produseer, die hoeveelheid van daardie vitamien ter beskikking van die skaap sou vergroot.

with the Oenological Research Institute of the Department of Agriculture, which will ultimately occupy the same building. Before going to Stellenbosch, the officer in charge of the Unit made a four months tour of Europe and California to study recent developments in research on the microbiology of wine making.

The Unit started an investigation of the causes of biotic turbidity in South African wines. This is a very serious problem in the industry. A large number of affected wines were examined and the yeasts present were isolated and identified. Highly significant results have already been obtained. It was found that approximately 50 per cent of the yeasts isolated belonged to the genus *Brettanomyces*. This proportion is very much larger than that reported in the case of French wines where the figure was of the order of 1 per cent. A study of the metabolism of these yeasts is now being undertaken to try to find the reason for their high incidence in local turbid wines as well as to find methods for preventing their development.

Work carried out overseas has shown that the bouquet of wines and brandies may be greatly influenced by the species of yeast used for fermentation. It has also been shown that the natural yeast flora on the grapes may vary very much in different localities. A study is therefore being made of the yeast flora of the vineyards and wine cellars in different parts of the Cape Province in an attempt to correlate these with the character of the wine produced in these areas.

#### Digestion and Metabolism in the Ruminant

This work is being carried out in collaboration with the Veterinary Research Laboratories at Onderstepoort.

#### *Influence of carbohydrates on the utilization of urea*

Counts were made of the number of bacteria belonging to various metabolic groups in the rumen of a sheep fed on different diets. It was found that changing the diet from glucose-urea-hay to starch-urea-hay resulted in a 20-fold increase in the number of cellulose digesting bacteria and a 6-fold increase in the number of lactic acid utilizing bacteria. Smaller changes were found in the numbers of organisms utilizing starch, glucose and xylose. These changes in the rumen flora could be one of the factors responsible for the fact that animals generally respond better to urea when starch is fed as carbohydrate supplement than when molasses is fed, since the increase in the number of cellulose digesting bacteria would enable the animal to make better use of the hay in the diet, while the increase in the lactic acid utilizing bacteria, which are active producers of vitamin B<sub>12</sub>, would increase the amount of the vitamin available to the sheep.

Biochemical studies also indicated that the pathways of the breakdown of glucose and starch by the same

Biochemiese navorsing het ook aan die lig gebring dat die manier waarop glukose en dié waarop stysel deur dieselfde grootpensbakterieë afgebreek word, van mekaar verskil. Dit skyn die sintese van bakterieproteïen uit ureum te beïnvloed. So word bv. wanneer glukose en ureum by 'n kunsmatige grootpensstelsel gevoeg word, groot hoeveelhede melksuur gevorm en die proteïensintese bly laag, terwyl in die geval van stysel en ureum, min melksuur gevorm word en die proteïensintese belangrik groter is. Dit skyn dat die ophoping van melksuur in die grootpens die gevolg is van die opbreking van koolhidraat wat so verloop dat dit nóg die energie nóg die tussenstowwe oplewer wat vir proteïensintese nodig is. Die mate waarin die opbreking so verloop, skyn afhanklik te wees van die tempo van die eerste stap wat vinniger in die geval van glukose is as by stysel. Die verskil in die metabolisme van glukose en stysel is miskien ook 'n faktor wat verantwoordelik is vir die beter gebruik van ureum wanneer stysel gevoer word. Hierdie navorsing duur voort.

#### *Selluloseverterende bakterieë in die grootpens*

Die bakterieë wat sellulose in die grootpens verteer, is belangrik aangesien hulle die gasheer in staat stel om sellulose te gebruik wat oor die algemeen 'n vername bron van energie in die dieet vorm. 'n Metode om hierdie organismes te tel, is uitgewerk en gebruik om die uitwerking van verskillende diëte op die aantal en die tipe sellulolitiese bakterieë in die grootpens te bestudeer. Daar is reeds na die resultate met die voer van ureum bereik, verwys. Dit het geblyk dat wanneer skape op 'n konsentraatryke dieet of op sappige groen lusern gevoer is, die tipe sellulolitiese bakterieë wat ontwikkel het, in voorkoms en voedingsbehoefte verskil het van dié by skape wat net op tefhooi gevoer is. Die medium wat gebruik is om laasgenoemde tipe organisme te tel, het ongeskik vir telling van eersgenoemde geblyk. Daar word tans getrag om 'n medium te ontwikkel om kulture van hierdie selluloseverteerders wat van 'n voedings-oogpunt kieskeuriger is, op te kweek.

'n Begin is gemaak om die verloop van sellulose-opbreking deur grootpensbakterieë afkomstig van skape wat op verskillende diëte gestel is, te bestudeer. Voorlopige proewe het aan die lig gebring dat wanneer byvoeding met 'n hoë proteïengehalte (100-150 g. witvismeel per dag) aan die diere gegee is, gewaste selsuspensies van die grootpensbakterieë sellulose *in vitro* in minder bruikbare sure en meer oortollige gas omgesit het as die geval was by organismes afkomstig van skape wat daagliks 50 g. vismeel gekry het. Hierdie waarnemings is belangrik omdat dit beteken dat sellulose in die grootpens op verkwistende manier opgebreek kan word en dat die persentasie sellulosevertering op sigself geen betroubare indeks is van die voordeel wat die dier uit die sellulose in sy dieet getrek het nie. Hierdie proefnemings word herhaal en uitgebrei.

population of rumen bacteria differ. This appears to influence the synthesis of bacterial protein from urea. Thus when glucose and urea are added to an artificial rumen system large amounts of lactic acid are produced and protein synthesis is low, whereas with starch and urea, little lactic acid is found and protein synthesis is significantly greater. It appears that the accumulation of lactic acid in the rumen is the result of the breakdown of carbohydrate taking a pathway which fails to supply either the energy or the intermediates needed for protein synthesis. To what extent the breakdown goes by this pathway seems to be governed by the rate of the initial step which is much more rapid in the case of glucose than of starch. This difference in the metabolism of glucose and starch may be another factor responsible for the better utilization of urea when starch is fed.

These studies are continuing.

#### *Cellulose digesting bacteria in the rumen*

The cellulose digesting bacteria in the rumen are important since they enable the host to utilize cellulose which generally constitutes a major source of energy in the diet. A method was developed for counting these organisms and was used to study the effect of various diets on the numbers and types of cellulolytic bacteria present in the rumen. Reference has already been made to the results obtained with urea feeding. It was found that, when sheep were fed a diet rich in concentrates or succulent green lucerne, the type of cellulolytic bacteria which developed differed in appearance and nutritional requirements from those in sheep receiving tef hay alone. The medium used for counting the latter type of organism proved unsuitable for the former. Efforts are being made to develop a medium for culturing these nutritionally more fastidious cellulose digesters.

A study of the pathway of cellulose breakdown by rumen bacteria from sheep on different diets was started. Preliminary experiments indicated that when the animals were given a high protein supplement (100—150 g. of white fishmeal per day), washed cell suspensions of the rumen bacteria converted cellobiose *in vitro* to less utilizable acids and more waste gas than did the organisms from sheep fed 50 g. fishmeal daily. These observations are of importance because they imply that cellulose can be broken down in the rumen in a wasteful manner and that the percentage cellulose digestion is not, by itself, a valid index of the benefit derived by the animal from the cellulose in its diet. This work is being repeated and extended.

## PROSESONTWIKKELING EN PROEFAANLEGWERKSAAMHEDE

### Waterontsouting deur Elektrodialise

Daar is aktief met hierdie onderneming voortgegaan in samewerking met die goudmynmaatskappye.

Geslaagde proefnemings met 'n prototipe eenheid vir 'n grootskaalse waterontsoutingsaanleg het daartoe gelei dat 'n groep goudmynmaatskappye besluit het om 'n installasie wat per dag 2½ miljoen gelling water kan ontsout, by die Free State Geduldmyne op Welkom, Oranje-Vrystaat, op te rig. Daar is teweens besluit dat hierdie installasie tot drie jaar lank as proefneming sou werk, indien dit nodig blyk.

Die besluit om tot die aanleg van hierdie installasie oor te gaan, is in September 1957 openbaar gemaak, en 'n verhandeling oor die werk is deur 'n senior lid van die laboratorium-personeel gelewer tydens die eerste Internasionale Simposium oor die Omsetting van Soutwater, wat in November 1957 in Washington D.C., V.S.A., gehou is. Die resultaat was dat heelwat belangstelling deur die buiteland vir die Suid-Afrikaanse werk aan die dag gelê is. Baie van diegene wat belang in die saak stel, reken dat die inligting uit die gebruikmaking van hierdie installasie verkry, die eerste betroubare leidraad sal wees vir die toepassing van elektrodialise op 'n werklike groot skaal, en ook 'n aanduiding van die te verwagte koste sal gee. Tot nog toe is sulke koste van betreklik kleinskaalse bedrywe bereken, dikwels van ontwerp wat ongeskik vir grootskaalse bedrywe is.

Nadat tenders oor die hele wêreld gevra is vir die vervaardiging, kragtens 'n lisensie, van die membrane deur W.N.N.R. ontwikkel en bestem vir gebruik in die groot aanleg, is die kontrak aan die Permutit-maatskappy, Bpk., Engeland, gegun.

Die W.N.N.R. het voortgegaan om die noue tegniese samewerking met die mynmaatskappye in verband met die groot aanleg te handhaaf, asook met die Permutit-maatskappy Bpk., wat die ontwikkeling van membrane betref.

Die werk in verband met klein installasies wat vir plaasgebruik en in plattelandse gebiede geskik is, is voortgesit in samewerking met die Landboudepartement en later ook met die Permutit-maatskappy Bpk., wat 'n deel van die werk geldelik steun. Vordering is enigszins vertraag, deels weens die ingewikkelde toestand in verband met internasionale patente wat elektrodialise betref, en deels weens tegniese moeikhede wat onafskedelik verbonde is met die ontwikkeling van feitlik outomatiese eenhede wat aan 'n groot verskeidenheid werkingstoestande voldoen wat samehang met 'n proses wat op die oomblik nog 'n mate van tegniese kontroliering vereis vir bevredigende langtermynwerking.

Ooreenkoms is bereik vir die aanvang van 'n reeks veldtoetse in Luderitz, Suidwes-Afrika, in verband met die elektrodialitiese ontsouting van seewater. Hierdie toetse staan op die lys om omstreeks Junie 1958 mee te

## PROCESS DEVELOPMENT AND PILOT PLANT ACTIVITIES

### Water Demineralization by Electrodialysis

Active work on this project was continued, in collaboration with the gold mining companies.

Successful tests on a prototype unit for a large scale water desalting plant led to the decision by a group of gold mining companies to erect a plant with a capacity of two-and-a-half million gallon a day at the Free State Geduld Mine at Welkom, Orange Free State. It was decided that this plant would operate up to three years on an experimental basis if necessary.

The decision to proceed with this large plant was publicly announced in September, 1957, and a paper on this work was presented by a senior member of the Laboratory staff at the first International Symposium on Saline Water Conversion at Washington D.C., U.S.A., in November, 1957. As a result, very considerable overseas interest has been shown in the South African work. Many of those interested consider that the information derived from the operation of this plant will give the first reliable guide to the feasibility of electrodialysis on a really large scale and to the actual costs that can be expected. Up to date, such costs have been projected from relatively small-scale workings often from designs unsuitable for large-scale operation.

As a result of the world-wide invitation to tender for the manufacture under licence of the membranes developed at the C.S.I.R. and to be used in the large plant, the Permutit Company Ltd, England was selected.

The C.S.I.R. continued to maintain close technical co-operation with the mining companies concerning the large plant, and with the Permutit Company Ltd. in respect of the development of membranes.

The work on small units suitable for farm use and in rural areas was continued in collaboration with the Department of Agriculture and, later, also with the Permutit Company Ltd. which is sponsoring a part of the work. Progress was somewhat delayed, partly by the complex international patent position in electrodialysis, and partly by technical difficulties inherent in developing virtually automatic units, capable of satisfying a wide range of operating conditions from a process that at present still requires a measure of technical control for its satisfactory long-term operation.

Agreement was reached for the start of a series of field tests at Luderitz, South West Africa, on the electro-dialytic desalting of sea water. These tests are scheduled to start about June, 1958. Although the production of fresh water from sea water is not normally considered to be economic, in this case there were reasons why the electrodialysis process might be the most practical one to cater for the steadily increasing demand on the municipality for fresh water.



begin. Hoewel die produksie van soetwater uit seewater gewoonlik nie as ekonomies beskou word nie, was daar in hierdie geval redes waarom elektrodialise die mees praktiese proses sou kan wees om in die geleidelik toenemende vraag om soetwaterverskaffing deur die munisipaliteit te voorsien.

'n Wetenskaplike uitgewersmaatskappy van internasionale bekendheid het sy wens te kenne gegee om 'n monografie oor die werk deur die W.N.N.R. en die goudmynmaatskappy te publiseer.

'n Steeds groter aantal versoeke om inligting oor die elektrodialiseproses is uit baie verskillende lande wat met ernstige brakwaterprobleme opgeskep is, ontvang. In baie gevalle wou dit voorkom dat uit 'n ekonomiese oogpunt—om nie van tegniese oorwegings te praat nie—die ontsouting van baie van hierdie watervoorrade uiters kosbaar sou wees, veral in lande waar elektriese krag duur is.

#### **Pynappelafval**

Die twee inmaakfabrieke wat die toetse uitvoer, het nadat voldoende materiaal vir voerproefnemings versamel was, met die ondersoek opgehou. Hoewel 'n bevredigende produk verkry kon word, het dit onwaarskynlik gelyk dat ekonomiese werking verkry sou kan word, selfs by produksie op groot skaal, vanweë die toestande met betrekking tot die betrokke fabrieke.

#### **Ondersoek van Reuke wat by Nywerheidsprosesse**

##### **Afgegee Word**

Die kontrak om 'n nywerheidsfirma te help om die reuke wat by sy prosesse afgegee word, uit te skakel, is beëindig nadat as gevolg van hierdie werk 'n geslaagde oplossing vir die moeilike probleem gevind is.

'n Aantal munisipaliteite het die W.N.N.R. genader in verband met die bestryding van aanstootlike reuke, en die nodige hulp is aan hulle verleen.

#### **Lugbesoedeling**

'n Lid van die laboratoriumpersoneel is in die Nasionale Advieskomitee vir Lugbesoedeling benoem.

#### **Die Gebruik van Neweprodukte van Chemiese**

##### **Prosesse**

Die werk volgens die beurskontrak waar verlede jaar melding van gemaak is, het goed gevorder. Dit het 'n stadium bereik waar oorweging aan halfskaalse produksie geskenk word, waardeur dit moontlik behoort te word om besluite in verband met verdere nywerheidsuitbreiding te neem.

#### **Industriële Verwerkingsprosesse**

Vakkundige tegniese hulp is volgens kontrak aan 'n aantal chemiese verwerkingsorganisasies verleen. Hoewel hierdie soort werk somtyds die langtermynnavorsingsprogram in die weg gestaan het, is dit onderneem toe geen ander bron van advies aan die hand gedoen kon

A scientific publishing company of international repute expressed its wish to publish a monograph on the work carried out by the C.S.I.R. and the gold mining companies.

An increasing volume of requests for information on the electrodialysis process came from a wide range of countries where large-scale brack water problems exist. In many cases it seemed that from economic, quite apart from technical, considerations the treatment of many of these waters would be very costly, especially where power was expensive.

#### **Pineapple Wastes**

The two canning factories carrying out the tests discontinued the investigation after enough material had been obtained for feeding trials. Although a satisfactory product could be obtained, it seemed unlikely that economic operation could be achieved, even on a large scale, owing to conditions relevant to the factories concerned.

#### **Industrial Odour Investigations**

The contract to assist an industrial firm to eliminate processing odours was concluded, a successful solution to a difficult problem having been found as a result of this work.

A number of municipalities approached the C.S.I.R. in connection with the control of obnoxious odours and assistance was given.

#### **Air Pollution**

A member of the Laboratory staff was appointed to the National Air Pollution Advisory Committee.

#### **Utilization of By-products from Chemical Processes**

The Fellowship contract reported last year continued to make good progress. The work approached the stage where semi-scale operations are being planned, which should enable decisions to be made on further industrial expansion.

#### **Industrial Processing Problems**

Specialist technical assistance was given, under contract, to a number of chemical processing organizations. This work, although occasionally interfering with the long-term research programme, was undertaken when no other source of advice could be suggested. It was of

word nie. Dit het heelwat daartoe bygedra om die nywerheid en die W.N.N.R. in noue voeling met mekaar te hou.

## **WATERNAVORSING**

### **Verdere Suiwering van Uitvloeiels van Rioolwatersuiweringswerke**

Die ondersoek, by wyse van proefnemings, in verband met die volkome oksidasie van ammonia in rioolafvalwater tot nitraat is voorgesit. Die resultate het die vorige bevindings volkome bevestig; die proewe wat tans aan die gang is, word gedoen om die bedryfs- en ekonomiese faktore van grootskaalse toepassing te beoordeel.

Ondersoek in verband met die reduksie van nitrate tot stikstofgas deur die deurlopende bakteriële nitrifiseringsproses wat in die Afdeling se laboratorium ontwikkel is, het sy slotstadium bereik.

Voldoende inligting is versamel om die werk tot proefaanlegexperimente uit te brei, veral met die oog op verlaging van die nitraatkonsentrasie van sekere onderaardse watervoorrade tot 'n veilige peil.

Navorsing is gedoen in verband met die bakteriebevolking van huishoudelike afvalwater en die getalvermindering van hierdie bevolking gedurende die verskillende stadia van die gebruiklike behandeling. As praktiese veronderstelling kan aangeneem word dat die vermindering in die aantal siektekieme wat ingewandskors veroorsaak, eweredig is met dié in die aantal ander organismes van fekale oorsprong. Die totale vermindering van afgesakte rioolvuil tot die finale, deur 'n humusenk en die sand gefiltreerde afvalwater, was tussen 30 en 70 persent, al na die lading en ontwerp van die suiweringsaanleg.

Poefnemings in verband met die doeltreffendheid van grasbeddings, algebeddings en verouderingsdamme by die verdere suiwering van uitvloeiels wat deur 'n humusenk en deur sand gefiltreer is, het op aanname van die verouderingsdam as laaste suiweringsseenheid voordat die afvalwater in 'n rivier vloei, uitgeloop. Die selfsuiwering wat in hierdie verouderingsdamme verkry is, was ekwivalent aan dié van myle stromende rivierwater en baie volumes verdunning met rivierwater. Die bakteriologiese kwaliteit van die gesuiwerde water uit hierdie damme was inderdaad baie goed; dit kon nie van dié van oppervlaktewater onderskei word nie en was baie beter as die van afvalwater deur sand gefiltreer.

Die gebruik van oksideerdamme vir die volledige behandeling van rou huishoudelike rioolwater was nog 'n resultaat van ondersoek in verband met verouderingsdamme. Dit sal miskien veral van nut kan wees vir kleiner dorpe wat nie kan bekostig om die gebruiklike rioolwatersuiweringsinstallasies te laat aanlê nie.

### **Rivieropnames**

Om 'n gesonde basis vir watergebruik te verskaf en stroomstandaarde te ontwikkel wat as grondslag vir

considerable benefit in keeping industry and the C.S.I.R. in close contact.

## **WATER RESEARCH**

### **Further Purification of Effluents from Sewage Works**

The pilot scale studies on the complete oxidation of ammonia in sewage effluents to nitrate have been continued. The results completely confirmed previous findings; present experiments are conducted to assess operational and economic factors of large-scale application.

Studies on the reduction of nitrates to nitrogen gas by the continuous bacterial denitrification process developed in the Division's laboratories, were carried to a final stage.

Sufficient information has been obtained to extend the work to pilot plant experiments, particularly with a view to reducing the nitrate concentration of certain underground water supplies to a safe level.

Studies were carried out on the bacterial population of domestic sewage and on the numerical reduction of this population during the various stages of conventional treatment. As a working assumption it can be accepted that the reduction in the number of enteric pathogens is proportional to that of the number of other organisms of faecal origin. The overall reduction from settled sewage to final humus tank and sand filtered effluent was found to be between 30 and 70 per cent, depending on load and design factors at the purification plant.

Experimental work on the efficacy of grass beds, algae beds and maturation ponds in the further purification of humus tanks and sand filtered effluents has culminated in the adoption of the maturation pond as a final purification unit before an effluent is discharged into a river. The self-purification achieved in these maturation ponds was equivalent to that of many miles of flowing river and many volumes of dilution with river water. The bacteriological quality of the purified water from these ponds was very high indeed; it was indistinguishable from that of surface water and much superior to sand filtered effluent. Maturation pond treatment effected an overall reduction in numbers of faecal organisms, and, therefore, also in the numbers of pathogens, of practically 100 per cent. This treatment was found to be as effective in the reduction of bacterial numbers as final chlorination of a sand filtered effluent.

The exploitation of oxidation ponds for the complete treatment of raw domestic sewage was a further outcome of investigations on maturation ponds. This may prove of special benefit to the smaller towns which cannot afford conventional sewage purification plants.

### **Stream Surveys**

The provision of a sound basis for water use and the development of stream standards upon which standards



standaarde vir gesuiwerde industriële afvalwater sou kan dien, volgens die vereistes van die Waterwet No. 54 van 1956, was dit nodig om die strome in ons land oor 'n uitgebreide gebied te ondersoek. Dit het 'n omvattende program vereis wat sowel die versameling van chemiese, biologiese en bakteriologiese inligting en vloei-gegewens dek, as laboratoriumstudies in verband met die chemiese en biologiese reaksies wat in watermassas en in riviermodder plaasvind.

Die voorbereidende chemiese opname van die opvanggebied van die Vaalrivier bokant die studam is voltooi. Hoewel die algemene chemiese gehalte van die water goed is, is definitiewe tekens van besoedeling gevind, en dit is heel moontlik dat die toenemende stedelike en industriële ontwikkeling in hierdie gebied met verloop van tyd 'n duidelike uitwerking op die gehalte van die water sal hê. Daar is bevind dat uitvloeisels wat ontstaan deur die industriële verwerking van landbouprodukte en as gevolg van die mynbedryf die vernaamste inloopstrome van die Vaaldam op verskeie punte invloei. Daar is veral aandag geskenk aan die aanwesigheid van sintetiese reinigingsmiddels in die uitvloeisels.

Die opname van die Vaalrivierstudam het aan die lig gebring dat daar min ernstige huishoudelike en industriële besoedeling is, behalwe in 'n klein gedeelte waar inloopstrome wat uitvloeisels van die Witwatersrand en Vereniging saamvoer, invloei. Hier is besoedeling aan die lig gebring deur veranderings van die fauna en die samestelling van die modder; daar was geen belangrike veranderings in die bakteriebevolking nie. Minerale besoedeling van die Vaalstudam was ernstig, veral in die reënseisoen.

Behalwe dat die modder- en sandsones van die rivierbedding nog nie ondersoek is nie, is die hoofopname van die Jukskei- en Krokodilrivierstelsel voltooi. Voldoende inligting omtrent die chemiese, bakteriologiese en faunistiese kenmerke van die rivier is versamel om van nut te wees by die eerste formulering van kwaliteitstandaarde vir uitvloeisels, veral dié afkomstig van rioolwatersuiwingsaanlêe. Die ingewikkelde Jukskei-Krokodilrivierstelsels sal miskien as algemene basis vir die vasstelling van uitvloeiselstandaarde en vir die beoordeling van besoedelingsgevolge gebruik kan word in gebiede waar geen omvattende gegewens omtrent riviere beskikbaar is nie. Die rede hiervoor is dat die stelsel noukeurige inligting verskaf omtrent die gevolge van besoedeling deur oppervlakafvloeewater afkomstig van digbevolkte gebiede, rioolwerke, fabriek en landbougebiede.

Die opname van die Tugelarivier, van sy oorsprong tot sy uitmonding in die see, en die ondersoek van 'n besoedelde deel van die Boesmans- en die Klein Boesmansrivier is voltooi. Die program het o.a. biologiese en chemiese ondersoeke gedurende al die seisoene van die jaar gedek, en ook die bepaling van die hoeveelheid slik deur die Tugelarivier saamgevoer wanneer hy afkom. Die resultate van hierdie opname het dit moontlik gemaak om

for purified industrial effluents could be formulated, as is required by Water Act No. 54 of 1956, made it necessary to pursue the investigation of streams along a very broad front. This involved a comprehensive programme of collection of chemical, biological and bacteriological information and flow data as well as laboratory studies on the chemical and biological reactions occurring in bodies of water and in river muds.

The preliminary chemical survey of the catchment area of the Vaal River above the barrage was completed. Although the general chemical quality of the water is good, definite signs of pollution were located and the increasing urban and industrial development in this area may well have a material effect on the water quality in course of time. Effluents arising from the industrial processing of agricultural products and from mining activities were found to enter the main tributaries of the Vaal Dam at a number of points. Particular attention was given to the presence of synthetic detergents in these effluents.

The survey of the Vaal River Barrage showed that there is little serious domestic and industrial pollution except in a short section where tributaries carrying flows from the Witwatersrand and Vereeniging enter. Here pollution was detected by changes in the fauna and the composition of the mud; there were no significant changes in the bacterial population. Mineral pollution of the Vaal Barrage was found to be severe, particularly during the rainy season.

Except for the investigation of the mud and sand zones of the river bed, the main survey of the Jukskei-Crocodile River system has been completed. Sufficient information on the chemical, bacteriological and faunistic characteristics of the river was collected to assist in the initial formulation of standards of quality for effluents, particularly those arising from sewage purification plants. The complex Jukskei-Crocodile River systems may provide a general basis for prescribing effluent standards and for assessing pollution effects in areas where comprehensive stream data are not available. This is because the system provides accurate information on the effects of pollution from surface run-off water coming from densely populated areas, from sewage works, from industrial establishments and from agricultural areas.

The survey of the main Tugela River from its source to the sea, and a study of a polluted section of the Bushman's and Little Bushman's Rivers were completed. The programme included biological and chemical studies during all the seasons of the year, as well as the assessment of silt loads carried by the Tugela River during flood periods. The results of this survey have made it possible to make some generalization with respect to the effects of urban, industrial and agricultural activities on stream life and water quality. They thus serve as a useful guide in the planning of future industrial establishments



tot 'n paar algemene gevolgtrekkings te kom wat die invloed van stedelike, industriële en landboubedrywighede op sowel die fauna en flora in die rivier as op die gehalte van die water betref. Sodoende vorm hulle 'n nuttige leidraad by die beplanning van toekomstige fabriek en woongebiede en by die vasstelling van standaarde vir industriële afvalwater en rioolwater.

Rivieropnames in Natal is met geldelike steun van die Natalse Stads- en Streeksbeplanningskommissie op 'n dergelike grondslag as in die geval van die Tugela-rivieropname, tot die stroomgebied van die Umgenirivier uitgebrei. Hoewel hierdie belangrike stroomgebied slegs effens meer as een sesde van die totale oppervlakte van Natal beslaan, word dit bewoon deur 70 persent van die Provinsie se blanke, Asiatiese en kleurlingbevolking en omtrent 18 persent van die natuurlike; 70 persent van Natal se industriële bedrywe bevind hulle in hierdie gebied.

#### **Tegniese Dienslewering aan die Departement van Waterwese**

Baie aansoeke om permitte vir die gebruik van water en om afvalwater te verwyder ingevolge die Waterwet No. 54 van 1956 is deur die Departement van Waterwese na die Afdeling verwys vir ondersoek en aanbeveling. In die geheel is 30 tegniese verslae met betrekking tot aansoeke om permitte ingelewer, wat 14 *ad hoc* ondersoeke in die veld vereis het.

#### **Tegniese Dienslewering aan ander Organisasies**

Die streekseenheid in Windhoek het baie doeltreffend gefunksioneer en gevolglik is besluit om 'n mobiele laboratorium te bou sodat meer intensiewe veldwerk gedoen kan word. 'n Aantal soetwatersones is in die bedding van die Swakoprivier en in die beddings van 'n paar van sy belangrikste syriviere gevind. Besoedeling van hierdie water deur soutwaterfontejies is bestudeer en in sommige gevalle was kwantitatiewe beoordeling nodig. Op hierdie manier is 'n taamlik duidelike beeld van die probleem van soutwaterbesoedeling verkry. Hierdeur is dit moontlik om die ondersoek in 'n meer spesifieke rigting te lei.

Tegniese dienste is ook aan die Windhoekse Munisipaliteit gelewer. Die uitbreiding van die werksaamhede van die Streekseenheid het die aanstelling van addisionele personeel vereis, en die Administrasie van Suidwes-Afrika het besluit om vir groter laboratoriumruimte te sorg.

Die Streekseenheid in Natal is baie besig gehou, veral met werk vir die Provinsiale Wateringenieur. Die verwydering van rioolwater en industriële afvalwater aan die Natalse Suidkus het 'n al hoe ernstiger probleem geword, vernameelik vanweë die besoedeling van die see en die strande.

Daar is baie minder dienste as vantevore aan fabriek en plaaslike besture gelewer in verband met die verwydering en suiwering van afvalwater. Weens dringende vraagstukke van meer belang vir die land, moes hierdie werk drasties ingekort word.

and residential areas and in the specification of standards for industrial and sewage effluents.

Stream survey activities in Natal were extended to the Umgeni River basin through the establishment of a Fellowship, similar to that of the Tugela River, by the Natal Town and Regional Planning Commission. This important river basin, although little more than one-sixth of the total area of Natal, accommodates some 70 per cent of the Province's European, Asiatic and coloured populations and about 18 per cent of its natives; 70 per cent of Natal's industrial establishments are to be found in this area.

#### **Technical Services to the Department of Water Affairs**

Many applications for permits to use water and to dispose of effluent in terms of Water Act No. 54 of 1956 were submitted by the Department of Water Affairs for investigation and recommendation by the Division. A total of 30 technical reports on application for permits were issued involving 14 *ad hoc* investigations in the field.

#### **Technical Services to Other Organizations**

The Regional Unit in Windhoek functioned very effectively and as a result it was decided to construct a mobile laboratory for the intensification of the field work. A number of fresh water zones were located in the bed of the Swakop River and in the beds of some of its most important tributaries. Contamination of this water with saline springs was studied and in some instances quantitative evaluation was possible. In this way a fairly clear picture of the problem of salt water contamination was obtained. This makes it possible to pursue more specific lines of investigation.

Technical services were also extended to the Windhoek Municipality. The extension in the activities of the Regional Unit necessitated the appointment of additional staff and the Administration of South West Africa decided to provide larger laboratory accommodation.

The Regional Unit in Natal was very active, particularly in respect of services to the Provincial Water Engineer. The disposal of sewage and industrial effluent along the Natal South Coast has become an increasingly serious problem, particularly because of the pollution of the sea and of bathing beaches.

Services to industrial establishments and local authorities in connection with the disposal and purification of effluents were continued on a much smaller scale than previously. Owing to pressing problems of more national importance this work had to be drastically curtailed.



**Diffusiestudies**

Die werk in verband met selfdiffusie in vloeibare mengsels is voortgesit. Twee binêre stelsels is volledig nagegaan, waarvan die een bykans ideale mengsels opgelewer het en die ander beslis geen ideale mengsels nie. Die metode wat gevolg is, het bestaan in gebruikmaking van koolstof-14-etikettering, brand volgens die welbekende Pregl-metode, en tel van die koolstof-14 as bariumpkarbonaat. Dit was nie maklik nie en baie tyd is bestee met die soek na verbrandingstoestande wat resultate oplewer wat ten opsigte van noukeurigheid redelik vergelykbaar is met die diffusieproewe self. In een stel mengsels waarvan een van die bestanddele koolstoftetrachloried was, is chloor-36-etikettering uitgevoer deur reaksie met watervrye aluminiumchloried. Die bedoeling in hierdie geval was om die chloor-36 in koolstoftetrachloried in die dampfase te meet met gebruik van dunwandige Geigertellers.

**Radiochemie**

Die beampte aan die hoof van hierdie Onderafdeling was die grootste deel van die verslagjaar oorsee om hom met die meer moderne metodes op die hoogte te stel. Die werk is derhalwe tot koolstof-14-analises beperk wat nodig is vir verskillende ander ondersoeke in die Laboratorium. Noudat die betrokke beampte terug is, word aandag bestee aan die verbetering van die telgeriewe, veral vir B-stralers met lae energie, soos koolstof-14 en tritium.

Voorbereidings word ook getref om die produkte van bestraling van gasse met röntgenstrale te bestudeer.

**Korrosie**

Beurswerk in verband met die korrosie van staal in gewapende beton is voortgesit onder die gesamentlike toesig van die Nasionale Bounavorsingsinstituut en die Nasionale Chemiese Navorsingslaboratorium. Toetsstukke vir grootskaalse ondersoek is gereed gemaak en word bestudeer, sowel in soutmistenks as op 'n buiterrein in Kaapstad waar die staal aan 'n sekklimaat blootgestel is en straf aangetas word. Werk in verband met bytteenwerkers vir staalwapenings is op 'n klein skaal voortgesit.

Die eerste reeks toetse waarby gegalvaniseerde yster blootgestel is, is voltooi. Hierdie toetse het geen noemenswaardige verskille tussen monsters uit verskillende bronne aan die lig gebring nie. Aangesien die resultate taamlik verstrooi was, is gevoel dat daar voortaan vir meer replisering voorsiening gemaak behoort te word. 'n Nuwe reeks is begin waarin die veranderlikes tot verskillende metodes vir die beskerming van sinkoppervlakke beperk is, en elke meting word tien maal gerepliseer.

Verder word korrosie in elektries verwarmede warmwatersilinders ondersoek. Behalwe dat geelkoper ontsink word, vind korrosie van koperbekledings plaas wat moeilik is om te verklaar.

**Diffusion Studies**

Work on self-diffusion in liquid mixtures continued. A complete study was made of two binary systems, one giving nearly ideal mixtures, and the other definitely non-ideal mixtures. The method adopted was to use carbon-14 labelling, burning by the classical Pregl method, and counting carbon-14 as barium carbonate. This did not prove easy, and much time was spent in choosing combustion conditions to give results reasonably comparable in accuracy to the diffusion experiments themselves. In one set of mixtures, using carbon tetrachloride as a component, labelling with chlorine-36 was carried out by reaction with anhydrous aluminium chloride. The intention in this case was to measure chlorine-36 in carbon tetrachloride in the vapour phase, using thin-walled Geiger counters.

**Radiochemistry**

During most of the past year, the officer in charge of this Section was overseas for training in more up-to-date techniques. The activities of the Section had therefore to be restricted to carbon-14 analyses, which are necessary to various other investigations in the Laboratory. With the return of the officer in charge, attention is being directed to improvement of facilities for counting, especially for low energy  $\beta$ -emitters such as carbon-14 and tritium.

Preparations are also being made to study the products of irradiation of gases with X-rays.

**Corrosion**

Work on corrosion of steel in reinforced concrete was continued as a Fellowship under the joint supervision of the National Building Research Institute and the National Chemical Research Laboratory. Large-scale test-pieces were prepared and are under study, both in salt-spray tanks and under very aggressive marine conditions at a site at Cape Town. Some work on inhibitors for steel reinforcing continued.

A first series of exposure tests on galvanized iron was completed. These did not show significant differences between samples from different sources. As there was a considerable scatter in the results it was felt that future work should allow for much more replication. A new series was started, in which the variables are restricted to different methods of protection of the zinc surface, and each measurement has ten replicates.

A study is being made of corrosion in electrically heated hot water cylinders. Apart from dezincification of brass, a corrosion of copper sheaths occurs which is difficult to explain.



Net soos in vorige jare is inligting in verband met korrosie-probleme verstrek en hulp verleen.

### Ioonselektiewe Membrane

'n Begin is gemaak om vas te stel hoe swaarmetaalione (bv. barium en ferri-) die elektrochemiese eienskappe van ioonselektiewe membrane wat by die elektrolitiese ont-souting van brakwater gebruik word, beïnvloed. 'n Studie is van die invloed van die bariumioon gemaak, waarby geblyk het dat negatiewe fenolsulfonaatmembrane by aanwesigheid van natrium groot selektiewe affiniteit vir hierdie ioon toon. Klein hoeveelhede barium word maklik uit 'n oplossing geabsorbeer en veroorsaak dan 'n skerp daling in die elektriese konduktansie van die membrane. Ander eienskappe, soos bv. selektiviteit, word ook geaffekteer, waarby die transportgetal van die chloriedioon in die membraan van 0.106 tot 0.110 styg, wanneer die membraan van die natrium- in die bariumvorm verander. Berekenings toon aan dat die beweeglikheid van die bariumioon ongeveer  $\frac{1}{12}$  van dié van die natriumioon is. Werk in verband met die invloed van die ferri-ioon duur voort.

Voortspruitende uit bevindings by die proefaanleg vir waterontsouting van die Anglo-American Corporation op Welkom, O.V.S., is 'n begin met 'n laboratoriumonderzoek gemaak in verband met die verwydering van die aanpaksel van aangepakte membrane deur middel van die omgekeerde polariteitmetode; 'n opsomming van die oorspronklike proefaanlegbevindings is vir publikasie ingestuur.

Laboratoriumproewe is gedoen in 'n apparaat met geflenste buisvormige glasafdelings. In die geval van negatiewe membrane met 'n aanpaksel wat hoofsaaklik bestaan uit 'n vaste oplossing van bariumstrontiumsulfaat, werd die membraan so geplaas dat die aanpaksel na die anodekant in die middelste van die vyf afdelings gekeer is. Die elektroliet aan die anodekant van die membraan is gevarieer om te sien watter uitwerking dit het, en dit het geblyk dat die aanpaksel vinniger verdwyn in die volgorde kaliumchloried, natriumchloried, natriumsulfaat. Die elektroliet se konsentrasie is ook gevarieer en daarby het geblyk dat lae konsentrasies doeltreffender is as hoë. Die gebruik van 'n vloeiende oplossing het die aanpakselverwydering ook vertraag. Toe die oplossing aan die anodekant flink geroer is, het daar niks van die aanpaksel verdwyn nie. Al hierdie waarnemings stem ooreen met die mening dat polarisasie by die raakvlak tussen die membraan en die oplossing gunstig is vir die aanpakselverwydering. Hoewel polarisasie dikwels vir aanpakselvorming in elektrodialise-apparate verantwoordelik is, verskaf dit tegelykertyd 'n metode om dit te verwyder.

'n Aanpaksel van magnesiumhidroksied is kunsmatig op 'n positiewe membraan aangebring en die uitwerking van omgekeerde polariteit is nagegaan. In hierdie geval is die aanpaksel verwyder; 'n paar ou heterogene membrane met 'n aanpaksel van kalsiumkarbonaat (afkomstig van

Information and assistance on corrosion problems were supplied as in previous years.

### Physical Chemistry of Permselective Membranes

Work was begun with a view to ascertaining the effect of heavy metal ions (e.g. barium and ferric) on the electro-chemical properties of permselective membranes used in the electrolytic demineralization of brackish water. A study of the effect of the barium ion was made, in which it was found that negative phenolsulphonate membranes show a great selective affinity for this ion in the presence of sodium. Small quantities of barium are readily absorbed from solution causing a sharp decrease in the electrical conductance of the membranes. Other properties, such as selectivity, are also affected, the transport number of the chloride ion in the membrane rising from 0.016 to 0.110 when the membrane is changed from the sodium to the barium form. Calculations show that the mobility of the barium ion is about one-twelfth of that of the sodium ion. Work on the effect of the ferric ion is in progress.

Arising out of findings made on the water demineralization pilot plant operated by Anglo American Corporation at Welkom, Orange Free State, a laboratory investigation was commenced on the subject of scale removal from scaled membranes by the reverse polarity method; a note giving the essence of the original pilot plant findings was submitted for publication.

Laboratory experiments were carried out in an apparatus having flanged glass tubular compartments. In the case of negative membranes fouled with barium strontium sulphate solid solution scale, the membrane is placed with the scale facing the anode side in the centre compartment of a five compartment assembly. The effect of varying the electrolyte on the anode side of the membrane was tried, and descaling was found to proceed more rapidly in the order potassium chloride, sodium chloride, sodium sulphate. The electrolyte concentration was also varied, and low concentrations were found to be more effective than high. The use of a flowing solution was found to retard descaling. Vigorous stirring of the anode-side solution was found to prevent it altogether. All these observations are consistent with a view that polarization at the membrane/solution interface favours descaling. Thus, while polarization is often responsible for scale formation in electrodialysis apparatus, it also provides a method for its removal.

A magnesium hydroxide scale was artificially deposited on a positive membrane and the effect of reversed polarity tried. Descaling occurred in this case; some old heterogeneous membranes scaled with calcium carbonate (from



proefaanlegwerk in 1954) is ook doereffend op hierdie manier behandel.

#### **Die Mangaan-kwiksisteem**

Die waarskynlike ruimtegroep van die verbinding  $Mn_2Hg_5$  deur middel van intensiteitsoorwegings is bepaal. 'n Struktuur kon afgelei word wat goeie ooreenstemming tussen waargenome en berekende intensiteite getoon het. Dit is 'n nuwe metaallaagstruktuur en is nou verwant aan dié van tetrammino-palladium-II-chloried. Noukeuriger intensiteitsdata is later verkry, wat dit moontlik gemaak het om die struktuur deur middel van Fourier-metodes te verfyn. 'n Kort oorsig van hierdie werk is reeds gepubliseer en sal later deur 'n vollediger verslag gevolg word.

#### **Gaschromatografie**

Hierdie werk is voortgesit in samewerking met die Departement Fisiese Chemie van die Universiteit van Pretoria. In die geval van skeiding van stowwe met 'n hoë kookpunt, met behulp van 'n vlamdetektor, is bevind dat dit dikwels moeilik was om 'n stabiele basislyn te handhaaf. 'n Alternatiewe opsporingsmetode was om die gas wat uit die kolom vloei, oor koperoksied te lei by  $800^{\circ}C$ ., die waterdamp te verwyder en die koolstofdioksied in 'n geleidingsvermoësel te meet. Dit het uitstekende resultate gelever. Nog 'n bevredigende metode was om 'n vlamdetektor te gebruik, maar in plaas van die temperatuur, die weerstand tussen twee elektrodes in die vlam te meet. Hierdie metode het ook baie gevoelig en betroubaar geblyk te wees.

#### **Die Kinetika van Selfoksidasie**

Gelyktydig met die ondersoek van selfoksidering van 5-metielnonaan wat vroeër in hierdie verslag reeds genoem is, is getrag om die kinetika van selfoksidering in die dampfase na te gaan. Die sisteem het egter te ingewikkeld geblyk vir 'n bevredigende vertolking van die resultate. Om die stelsel eenvoudiger te maak, is selfoksidering van isobutaan uitgekies vir bestudering en is voorlopige metings gedoen. Hierdie is reeds in die bestaande literatuur beskryf, maar in die onderhawige geval is temperatuur in die reagerende gas direk gemeet. Toe die reaksie na die induksieperiode begin het, is bevind dat die reagerende mengsel nie isotermies gehou kon word nie, dog dat sy temperatuur met 'n maksimum hoeveelheid van ongeveer  $2^{\circ}C$ . gestyg het.

#### **Die Analitiese Laboratorium**

Net soos in die verlede is essensiële dienste gelever. Onder die roetindienste was daar noukeurige ontledings van monsters vir geochronologiese ondersoek en van verwysingsmonsters vir die nywerheid.

pilot plant work in 1954) were also effectively treated by this method.

#### **The System Manganese-Mercury**

The probable space group of the compound  $Mn_2Hg_5$  was determined from intensity considerations. A structure could be derived which gave good agreement between observed and calculated intensities. It is a new metallic layer structure and is closely related to that of tetrammino palladium (II) chloride. More accurate intensity data were later obtained, allowing the structure to be refined by Fourier methods. This work has been published in the form of a note, and publication in more detail will follow.

#### **Gas Chromatography**

Work was continued in collaboration with the Physical Chemistry Department of the University of Pretoria. For separations of high boiling substances, using a flame detector, it was found that a stable base-line was often difficult to maintain. An alternative detection method was to lead the effluent gas from the column over copper oxide at  $800^{\circ}C$ ., remove water vapour, and measure carbon dioxide in a conductivity cell. This gave excellent results. Another satisfactory method was to use a flame detector, but to measure the resistance between two electrodes in the flame instead of temperature. This also proved a very sensitive and stable method.

#### **Kinetics of Autoxidation**

In conjunction with studies of autoxidation of 5-methyl nonane mentioned earlier in this report, an attempt was made to follow the kinetics of autoxidation in the vapour phase. The system, however, proved too complex for satisfactory interpretation of the results. In order to simplify the system, autoxidation of isobutane was selected for study and preliminary measurements were made. This reaction has been studied previously in the literature, but, in the present case, temperatures in the reacting gases were measured directly. When reaction commenced after the induction period, it was found that the reacting mixture could not be kept isothermal but increased in temperature by a maximum amount of about  $2^{\circ}C$ .

#### **Analytical Laboratory.**

As in past years essential services were rendered. Among the more routine services, accurate analyses were carried out on samples for geochronological investigations and on reference samples for industry.



# Nasionale Fisiese Navorsingslaboratorium

*Direkteur:* DR. E. J. MARAIS

Ontwikkelings in die wiskunde- en statistiekaangeleenthede van die Nasionale Fisiese Navorsingslaboratorium het die instelling van drie wiskundige afdelings genoodsaak—'n afdeling vir toegepaste wiskunde, 'n afdeling vir wiskundige en toegepaste statistiek en 'n afdeling vir biometrie. Behalwe basiese navorsingswerk voorsien hierdie afdelings gesentraliseerde wiskunde en statistiekdienste aan meeste van die Wetenskaplike en Nywerheidsnavorsingsraad se afdelings.

In die afgelope paar jaar het die behoefte aan 'n rekenoutomaat vir gebruik by allerlei navorsingsprojekte hom reeds laat voel. 'n Elektroniese rekenoutomaat wat as „Zebra” bekend staan, is derhalwe aangekoop en word binnekort geïnstalleer.

## KERNFISIKA

### Kernemulsies in Kernfisiese Navorsing

In die vorige verslag is vermeld dat kernemulsies gebruik kan word vir die registrasie van die bane van vinnig bewegende deeltjies. Die ontwikkelde emulsies kan onder 'n mikroskoop ondersoek word.

In 'n projek wat in die Afdeling Kernfisika onderneem is, is die isotope waterstof, koolstof-12 en jodium-127 beskiet met siklotronversnelde alfadeeltjies. Tydens bombardering van waterstofkerns d.w.s. protone deur alfadeeltjies, is die waarskynlikste wisselwerking die oordrag van die hele alfaenergie op die proton. Die intensiteit en energie van hierdie sogenaamde aanslagprotone is by verskillende verstrooiingshoeke bestudeer, en met die resultate van die verstrooiing van protone van alfa-kerns af, vergelyk. Verder is die intensiteit en energie van die alfadeeltjies wat deur jodium-127 en koolstof-12 verstrooi is, bestudeer, en hierdie resultate word tans met teorie vergelyk.

Die kontinue en gelykmatige gevoeligheid van emulsies oor 'n groot energiebereik van betastrale, is met groot sukses in die betaspektrometer met permanente magneet aangewend. Dié resultate word in 'n ander onderafdeling in meer besonderhede bespreek.

### Die W.N.N.R.-Siklotron

Die siklotron kan tans by maksimumenergie en met die maksimumbundelintensiteit wat die binnekomponente kan verdra, op betroubare wyse fungeer. Die basiese moeilikheid weens 'n geboë magnetiese mediaanvlak, wat in die vroeër stadiums vooruitgang gestrem het, is uiteindelik uit die weg geruim. Verdere verbeterings

# National Physical Research Laboratory

*Director:* DR. E. J. MARAIS

Developments in the mathematical and statistical activities of the National Physical Research Laboratory have made it necessary to establish three mathematics divisions—a division for applied mathematics, a division for mathematical and applied statistics and a division for biometrics. Apart from basic research, these divisions provide centralized mathematical and statistical services to most of the departments of the Council for Scientific and Industrial Research.

During the past few years the necessity for acquiring a digital computer for a variety of research projects has been felt. An electronic digital computer known as “Zebra” has therefore been purchased and is due for installation shortly.

## NUCLEAR PHYSICS

### Nuclear Emulsions in Nuclear Physical Research

As mentioned in the previous report, nuclear emulsions can be used for the recording of the tracks of swiftly moving particles. The developed emulsions can then be examined under a microscope.

In a project undertaken in the Nuclear Physics Division hydrogen, carbon-12 and iodine-127 isotopes were bombarded by cyclotron accelerated alpha particles. In the bombardment of hydrogen nuclei (that is, protons by alphas), the interaction most likely to occur is the transfer of all the alpha energy to the proton. The intensity and energy of these so-called knock-on protons were studied at various scattering angles, and compared with the results of the scattering of protons from alpha-nuclei. Furthermore the intensity and energy of the alphas scattered from iodine-127 and carbon-12 were studied, and results are now being compared with theory.

The continuous and even sensitivity of emulsions over a large energy range of betas, was utilized with great success in the permanent magnet beta-ray spectrometer. These results are discussed in greater detail in another section.

### The C.S.I.R. Cyclotron

The cyclotron is now capable of reliable performance under maximum energy conditions at the maximum beam intensity that the interior components are able to withstand. The basic difficulty of a buckled magnetic median plane, which considerably impeded progress during earlier stages, has now finally been overcome, and further



aan ander basiese komponente, byvoorbeeld die radio-frekwensie-oscillator, die vakuumstelsel en die metodes van verbeheer, dra aansienlik by tot die gewenste stabiliteit van die werkverrigting.

Geslaagde bestralings (van koper, goud, silwer, natriumchloried, palladium, lood, berillium, ens.) met deutrone, alfadeeltjies en protone is uitgevoer. Sommige bestralings het selfs sewentig uur lank onafgebroke geduur. (Die radioaktiewe produkte is gebruik vir fundamentele navorsing in verband met kernstruktuur, wat elders beskryf word.)

Bouwerk in verband met die uitbreiding van die siklotronsaal, het 'n aanvang geneem en eksperimente vir die uitbring van die siklotronbundel is aan die gang. Al die nodige onderdele vir hierdie doel is reeds vervaardig en geïnstalleer.

As gevolg van die installering van beter elektroniese toerusting, is beheer vergemaklik, en is noukeuriger metings tans moontlik.

Die siklotron is in so 'n mate ontwikkel, dat hy aan die ontwerpverwagtings voldoen en gereed is vir die verdere wysigings wat van eksperiment tot eksperiment vereis word.

#### Isotoopafskeier

Namate die konstruksie van die isotoopafskeier gevorder het, is elke onderdeel na voltooiing, aan 'n deeglike toets onderwerp. Die groot elektromagneet en sy hulptoerusting is gemonteer. Metings van die magneetveld het getoon dat die veld meer as 2 dele op 1000 homogeen is—wat vir 'n magneet van hierdie grootte goed is. Die versnellingspanning van 80 Kv is getoets en stabiel gevind, met 'n wisseling van minder as 0.1%. Volgens voorlopige toetse van die ionebron en fokuseringstelsel werk die kombinasie bevredigend, en lewer hy 'n goed gedefinieerde ionebundel aan die magneet. 'n Elektroniese stroomintegrator en ionebundelstabiliseerder is gebou en getoets. Die beheerstelsel is tans volledig.

Gedurende Desember 1957 is die isotoopafskeier vir die eerste maal in sy geheel gemonteer. Om dit op die proef te stel, is afskeidings van die isotopiese komponente van verskillende elemente onderneem. Die isotope van lood, kwik, xenon, kripton en suurstof is geskei. Die resultate van hierdie skeidings toon dat hierdie isotoopafskeier met die beste in sy soort in die wêreld vergelyk.

#### Kernteorie

Volgens langse ondersoeke van die meerliggaam-probleem van die kern is die wisselwerking van 'n nukleon met sy bure in die kern snelheidsafhanklik, en nie-lokaal in sowel die momentum as die koördinate ruimte.

As aangeneem word dat die nie-lokale effekte klein is, blyk dit uit berekenings dat die nukleone beskou kan word as „kerndeeltjies” wat in die lokale kernpotensiaal beweeg, maar met 'n kleiner effektiewe massa as dié van die vrye nukleon. Die massavermindering hang af

improvements to other basic components, for example the radio-frequency oscillator, the vacuum system and the methods of remote-controlled operation, contribute considerably to the desired stability of operation.

Successful irradiations (of copper, gold, silver, sodium chloride, palladium, lead, and beryllium) with both deuterons and alpha-particles and also protons were carried out, some lasting as long as 70 hours at a time. (The radioactive products were used for fundamental research into nuclear structure, as described elsewhere.)

Building operations on the extension of the cyclotron hall were started, and experiments for the extraction of the beam are under way. For this purpose all the necessary components have already been manufactured and installed. As a result of the installation of improved electronic equipment, control is facilitated and more accurate measurements are possible.

The cyclotron has now been developed to such an extent that it measures up to design expectations and is ready for further modifications as required from experiment to experiment.

#### Isotope Separator

As the construction of the isotope separator progressed each component was given a thorough test upon completion. The large electro-magnet and auxiliary equipment has been assembled. Measurements on the magnetic field showed that the inhomogeneity is less than 2 : 1000, which is good for a magnet of this size. The acceleration potential of 80 KV was tested and found to be stable, varying less than 0.1 per cent. Preliminary tests on the ion source and focussing system showed that the combination worked satisfactorily and that it supplied a well defined ion beam to the magnet. An electronic current integrator and ion beam stabilizer were built and tested. The control system is now complete.

During December, 1957, the isotope separator was assembled for the first time. To test it, separations of different elements into their isotope components were undertaken. The isotopes of lead, mercury, xenon, krypton and oxygen were separated. The results of these separations show that this isotope separator is comparable with the best of its type in the world.

#### Nuclear Theory

Recent investigations of the nuclear many-body problem have shown that the interaction of a nucleon with its neighbours in a nucleus is velocity-dependent, or non-local in both momentum and co-ordinate space.

Assuming that the non-local effects are small, calculations show that the nucleus can be regarded as nuclear “particles” moving in the local nuclear potential but having an effectively smaller mass than the free nucleon,



van die lokale sterkte van die wisselwerking waaraan die nukleon onderworpe is.

Wanneer die isotropiese harmoniese ossillatorpotensiaal as kernpotensiaal gebruik word, lei berekenings met hierdie benadering van „effektiewe massa” tot enkeldeeltjie-energievlakskemas wat in wese soos dié is wat gewoonlik as uitgangspunt vir skilmodelberekenings aangeneem word. Daar is egter ’n herordering van hierdie energievlakke op die gebied van toestande met hoër draaimomentum, wat beter ooreenstem met die eksperimenteel vasgestelde empiriese skemas. Hierdie herordering van die energievlakke is ’n direkte gevolg van die nie-lokale wisselwerking, wat ’n kragtiger binding van die toestande van hoër draaimomentum teweegbring. Die berekende waardes van die bindingsenergieë van die „laaste onewe nukleon”, gedoen met hierdie eenvoudige model, toon verder ’n treffende ooreenstemming met die eksperimentele waardes.

Hierdie resultate is in „Nuovo Cimento” gepubliseer.

Die nie-lokale uitwerking op die onafhanklike beweging van nukleone, in ’n vervormde kernpotensiaal, is ook ondersoek. Deur ’n sferiese harmoniese ossillatorpotensiaal as kernpotensiaal te neem, voorspel hierdie model ewewigskernvervormings en vierpoolmomente wat goed met die empiriese waardes ooreenstem. In die besonder voorspel die nie-lokale model die oorwig van positiewe kernmomente, wat eksperimenteel gevind word. Hierdie effek kan toegeskryf word aan die sterkere binding van die toestande met hoër draaimomentum wat die nie-lokale wisselwerking meebring.

#### Betastraalspektrograaf met Permanente Magneet

Verdere studies, met die betastraalspektrograaf met permanente magneet uitgevoer, het tot ’n verbasend verbetering van dié tegniek, en tot suksesvolle toepassing daarvan gelei. Hierdie apparaat, wat veral vir die meting van omvormingslyne geskik is, word tans met kern-emulsies as detektors gebruik. Op die oomblik, waar die noukeurigheid van metings van inwendige omvormings toeneem, is ’n punt bereik waar dit moontlik is om die uitwerking van die eindige grootte van die kern op die inwendige omvormingskoëffisiënt waar te neem. Dit is dus van die grootste belang om die inwendige omvorming by die verskillende oorgange te bestudeer. Hierdie metings is tans aan die gang. Die geval van elektriese vierpoolstraling is reeds bestudeer en die resultate aan Physical Review gestuur.

#### KERNSPEKTROSKOPIE

##### Verval van Uraan-Z

Gedurende Oktober is die werk in verband met die afskeiding van torium-234 (uraan-XI) en protactinium-234 (uraan-Z), uit die moederoplossing van uraan-238, afgehandel en is dit tans moontlik om draervrye uraan-Z

the mass reduction depending on the local strength of the interaction felt by the nucleon.

Using the isotropic harmonic oscillator potential for the nuclear potential, calculations in this “effective mass” approximation lead to single particle energy level schemes essentially similar to those which are usually assumed as a starting point for shell model calculations. There is, however, a re-ordering of these energy levels in the region of high angular momentum states which is in better agreement with the empirical schemes determined by experiment. This re-ordering of the energy levels is a direct consequence of the non-local interaction which results in a stronger binding of the higher angular momentum states. Furthermore, the calculated values of the binding energies of “the last odd nucleon” on this simple nuclear model are in striking agreement with the experimental values.

These results were published in the “Nuovo Cimento”.

The non-local effects on the independent motion of nucleons in a deformed nuclear potential were also investigated. Using the spheroidal harmonic oscillator potential for the nuclear potential, this model predicts nuclear equilibrium deformations and quadruple moments which are in good agreement with the empirical values. In particular, the non-local model predicts the preponderance of positive nuclear moments, which is found experimentally. This effect can be ascribed to the stronger binding of the higher angular momentum states which the non-local interaction introduces.

#### Permanent Magnet Beta Ray Spectrograph

Further studies undertaken with the permanent magnet beta ray spectrograph have led to remarkable improvement of the technique and successful application. This apparatus, which is especially suited for the measurement of conversion lines is now used with nuclear emulsion plates as detectors. At the moment, while the accuracy of internal conversion measurements is increasing, the point is reached where the effect of finite size of the nucleus on the internal conversion coefficient can be detected. It is therefore of the greatest interest to study internal conversion in the different transitions, and these measurements are now in progress. The case of an electric quadrupole radiation has already been studied and the results submitted to the Physical Review.

#### NUCLEAR SPECTROSCOPY

##### Decay of Uranium-Z

During October the work concerning the separation of the thorium-234 (uranium-XI) and protactinium-234 (uranium-Z) from the uranium-238 mother solution was finalized and it is now possible to prepare carrier-free



te berei. Met hierdie bronne is 34 waarnemingsreekse in die betaspektrometer uitgevoer met die neem van betagammaoïnsidensies. In hierdie waarnemingsreekse, wat elk 40 uur in beslag neem, word vasgestel in hoeveel gevalle 'n gammastraal met 'n sekere energie, gelyktydig uitgestraal word met 'n betastraal, waarvan die energie deur die spektrometer uitgesoek word. Met hierdie hoogsgevoelige metode is ses parsieële betaspektrums in die uraan-Z-verval ontdek. Gelyktydig kon die hoofgammastrale aan hulle respektiewe posisies in die verval-skema toegeken word. Verdere metings word voortgesit, en berekenings word op die resultate uitgevoer.

#### **Fokussing van Gelaaiete Deeltjies**

Die studie van die magnetiese fokussing van gelaaiete deeltjies met behulp van vierpole, het gelei tot 'n vereenvoudigde behandeling van die teorie. Dit is moontlik gemaak deur die beginsels van geometriese optika op die magnetiese vierpoollense toe te pas. Hierdie eenvoudige metode stel ons in staat om selfs gekompliseerde lensstelsels te hanteer, en sal op verskillende maniere toegepas kan word, veral in verband met die uitgetrekte siklotronbundel.

#### **Eksperimente oor die Dubbele Verstrooiing van Elektrone**

Polarisasie, een van die mees treffende verskynsels in die stralingsfisika, word waargeneem in 'n eksperiment in verband met die verstrooiing van 'n elektronebundel. Indien 'n deeltjebundel, byvoorbeeld 'n elektronebundel, tweemaal verstrooi word, toon die verstrooide intensiteit 'n asimmetrie ten opsigte van die oorspronklike rigting. Hierdie effek is te wyte aan die feit dat hierdie deeltjies 'n intrinsieke draaimomentum besit, die sogenaamde spin.

In ons eksperiment is hierdie effek vir goud-goud-verstrooiing in die energiegebied 60,000 tot 100,000 volt elektrone-energie gemeet. Die gemete waarde is laer as die asimmetrie wat teoreties voorspel word, maar toon die verwagte verandering met energie.

#### **TOEGEPASTE RADIOAKTIWITEIT**

'n Oplossing van radioaktiewe natrium-24, in die plaaslike siklotron berei, is in 'n reeks eksperimente saam met die Nasionale Bounavorsingsinstituut gebruik om die doeltreffendheid van verskillende vloddertegniese in voorgespanne gewapende beton te ondersoek.

'n Instrument vir die bestraling van grondboontjie-saad met die gammastrale van 1 curie kobalt-60 is ontwikkel met die oog op die vermeerdering van die aantal natuurlike mutasies vir teeltdoeleindes. Vier pakke van 15 pd. elk het verskillende dosisse oor 'n tydperk van 'n week ontvang. Die plante van hierdie saad gekweek, toon definitiewe stralingseffekte dog daar sal eers oor 'n

uranium-Z. With these sources 34 runs in the beta ray spectrometer, taking beta-gamma coincidences, have been carried out. These runs, each of which takes 40 hours, consist in the measurement of the number of events in which a gamma ray with a certain energy and a beta ray also energetically selected in the spectrometer, are emitted simultaneously. With this method of highest sensitivity six partial beta spectra of the uranium-Z decay were discovered. At the same time the major gamma rays could be assigned to their respective positions in the decay scheme. Further measurements are still in progress and calculations are being carried out on the results.

#### **Focussing of Charged Particles**

The study of quadrupole magnetic focussing of charged particles has led to the development of a simplified treatment of the theory. This was made possible by applying the principles of geometrical optics to the magnetic quadrupole lenses. This simple method allows of the handling of quite complicated lens systems and will find different applications especially in connection with the focussing of the extracted cyclotron beam.

#### **Double Scattering Experiments with Electrons**

Polarization, one of the most striking phenomena in radiation physics, is observed in an experiment dealing with the scattering of an electron beam. If a beam of particles, for example an electron beam, is scattered twice, the scattered sensitivity shows asymmetry in respect to the initial direction. This effect is due to the fact that these particles possess an intrinsic angular momentum, the so-called spin.

In our experiment this effect has been measured in the energy range 60,000—100,000 volt electron energy in the case of gold-gold scattering. The measured value is lower than the theoretically predicted asymmetry but shows the expected variation with energy.

#### **APPLIED RADIOACTIVITY**

A solution of radio-active sodium-24 prepared in the cyclotron of this Laboratory, was used in experiments with the National Building Research Institute for determining the efficacy of grouting in pre-stressed concrete.

An instrument was developed for irradiating groundnut seed with gamma radiation from a one-curie cobalt-60 source in order to increase the number of mutations available for breeding purposes. Four lots of 15 lbs. each were given different radiation doses over a period of about a week. These seeds were planted out and are showing definite radiation effects, but a few years will be required to find reproducible varieties.



paar jaar vasgestel kan word of daar wel geskikte variëteite verkry is.

Lekke in die Rooiwal-rioleringspyplyn is met welslae deur middel van 'n radioaktiewe oplossing opgespoor.

'n Instrument, wat van die absorpsie van beta-straling gebruik maak, word ontwikkel om die bewegingsnelheid van steenkoolstof te meet by ondersoeke van verbrandings-enjins deur die Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese uitgevoer.

#### **Vergadering van Deskundiges op die Gebied van Radioaktiewe Isotope**

Die Laboratorium het in Julie in Pretoria deelgeneem aan 'n besonder geslaagde byeenkoms van deskundiges op die gebied van radioaktiewe isotope onder beskerming van die Wetenskaplike Raad vir Afrika Besuide die Sahara. Ses verhandelinge oor die toepassing van radioaktiewe isotope, standaardisering en gesondheidsbeskerming is deur personeellede van die laboratorium gelewer. Die geleentheid om met wetenskaplikes van naburige state gemeenskaplike belange te bespreek, het wedersydse voordele meegebring.

#### **Besoek aan Industriële Sentra aan die Kus**

Drie lede van hierdie laboratorium, het saam met 'n lid van die Buro vir Standaarde, 'n reis van drie weke onderneem waartydens hulle geslaagde besoeke gebring het aan die belangrikste industriële sentra aan die kus, naamlik Kaapstad, Port Elizabeth, Oos-Londen en Durban. Voorlesings oor die toepassing van radioaktiwiteit in die nywerheid is gelewer en verskillende firmas waar dié toepassing wel moontlik is, is besoek.

Moontlike projekte wat na aanleiding van die besoek oorweeg kan word, is byvoorbeeld die ondersoek van die beweging van rioolafval in die see; die meting van die voggehalte van grond, goiing, papier, ens., met neutronvogmeters, en die beweging van sand in die hawens.

Soortgelyke lesingstoere is ook na Sasolburg en Bula-wyo onderneem.

### **BIOFISIKA**

#### **Radiobiologie**

In samewerking met 'n navorsingsgroep van die Johannesburgse Hospitaal is 'n begin gemaak met voorlopige ondersoeke in verband met die stralingsgevoelheid van sekere muiskankers waarby die straling afkomstig van radioaktiewe isotope, in die plaaslike siklotron vervaardig aangewend word.

#### **Spannings wat in die Baarmoeder Voorkom**

Geen verder werk is gedoen in verband met die veranderings in die elastisiteit van die cervix as gevolg van swangerskap en bevallings nie. Daar is egter 'n verhandeling geskryf oor die vorige werk en hieruit blyk dat 'n bevalling nie, soos algemeen gemeen word, 'n permanente verandering in die elastisiteit van die cervix veroorsaak nie.

Using a radioactive solution, the position of leaks in the Rooiwal sewage pipeline in Pretoria were successfully located.

An instrument, making use of the absorption of beta radiation, is being developed to determine the rate of flow of coal dust in combustion engine studies by the National Mechanical Engineering Research Institute.

#### **Specialists' Meeting on Radioisotopes**

During July the Laboratory co-operated in the organization of a very successful specialists' meeting on radioisotopes in Pretoria under the auspices of the Scientific Council for Africa South of the Sahara. Six papers on radioisotope application and standardization and on health control were presented by staff members of the Laboratory. The opportunity of meeting and discussing questions of common interest with scientists from neighbouring countries was of mutual benefit.

#### **Tour of Coastal Industrial Centres**

Three members of this Laboratory, accompanied by a member of the Bureau of Standards, made a successful two-week tour of the major industrial centres along the coast, namely, Cape Town, Port Elizabeth, East London and Durban. Lectures on the application of radioactivity in industry were given and visits paid to firms with possible applications. Possible projects to be considered arising from this tour are the tracing of sewage movement in the sea; the determination of moisture content of soil, jute, paper, etc., with neutron sources, and the following of the movement of sand in harbours.

Similar lecture visits were paid to Sasolburg and Bulawayo.

### **BIOPHYSICS**

#### **Radiobiology**

In co-operation with a research group from the Johannesburg Hospital, preliminary studies have been started on the radio-sensitivity of mouse tumours using radiation from the cyclotron.

#### **Forces in the Uterus**

No further work on the changes in the elastic constants of the cervix-uteri as a result of pregnancy and parturition was carried out, but a paper on previous work was written. This paper indicated that, contrary to general belief, the experience of parturition did not produce a permanent change in the elastic constants of the cervix.



## SPEKTROSKOPIE

Vir die studie van die vibrasierigtings van die molekulgroepe in p-dichloorbenseen het dit nodig geword om enkelkristalle tussen die natriumchloriedvensters te laat groei. Die x-as van die kristalle moes loodreg (of amper loodreg) op die vlakke van die natriumchloriedvensters wees. 'n Spesiale apparaat is vir hierdie doel gebou en uit voorlopige eksperimente het dit geblyk dat, indien ingeënte kristalle met die regte rigting gebruik word, dit moontlik behoort te wees om kristalle met die verlangde oriëntasie te laat groei. Die hoofprobleem is om laterale groei tussen die natriumchloriedvensters te voorkom wanneer die gesmelte materiaal in hierdie gebied stol.

'n Verbode elektroniese bandsisteem in die spektrum van die tegnologies belangrike koolmonoksiedmolekuul, waarvan die spektrum nie op grond van die aanvaarde energieniveauskema verklaar kon word nie, word in samewerking met twee oorsese navorsingslaboratoriums bestudeer. Daar is aanduidings dat die klassifikasie van een van die elektroniese energieniveaux verkeerd is.

In samewerking met die Nasionale Chemiese Navorsingslaboratorium is 'n spektroskopiese metode ontwikkel om te onderskei tussen die vakuüm-ultraviolet-absorpsie van gekonjugeerde en geïsoleerde dubbelbande in die struktuur van die langkettingsuurbestanddeel van natuurlike olies.

In die nuwe gebou is 'n groot roosterspektrograaf vervaardig en opgestel.

Op hierdie instrument kan spektra, onder die groot dispersie en oplosvermoë wat nodig is vir die studie van komplekse spektra, gefotografeer word. Tans word die opwekking van spektra van astrofisiese belang ondersoek.

## CHEMIESE FISIKA

### Bepalings van Vitamien A

'n Studie is gemaak van die Carr-Price-reaksie met behulp van 'n registrerende ultraviolet-spektrofotometer. Metodes vir die bepaling van die konsentrasies van vitamien-A-asetaat, vitamien-A-alkohol, C<sub>17</sub>-suur en C<sub>17</sub>-alkohol is ontwikkel.

### Radiometriese Metodes vir die Bepaling van Uraan en Torium

Radiometriese metodes, wat gebruik maak van die betastrale, die geïntegreerde gammastrale bo 100 keV, en van die gammastrale in die 2.62-MeV-piek van torium C'', is ontwikkel om uraan en torium gelyktydig n gemaalde en geloogde erts te bepaal. Hierdie tegnieke word tans gestandaardiseer met behulp van monsters wat vooraf noukeurig met behulp van chemiese of massaspektrometriese metodes geanaliseer word.

## SPECTROSCOPY

For the study of the modes of vibrations of the molecules p-dichlorobenzene it became necessary to grow single crystals between the rocksalt windows. The x-axis of the crystals had to be perpendicular (or nearly perpendicular) to the faces of the rocksalt windows. A special apparatus was constructed for this purpose and preliminary experiments, using small seed crystals with the correct orientation, showed that it should be possible to grow crystals with the desired orientation. The main problem is to avoid the lateral growth between the rocksalt windows, when the molten material in this area solidifies.

A forbidden electronic band system in the spectrum of the technologically important carbon monoxide molecule, the structure of which could not be explained according to the accepted energy level scheme, is being studied in collaboration with two overseas research laboratories. There are indications that the classification of one of the electronic energy levels is wrong.

A spectroscopic method was developed in collaboration with the National Chemical Research Laboratory to distinguish between the vacuum ultra-violet absorption of conjugated and isolated double bonds in the structure of the long chain acid constituent of natural oils.

A large grating spectrograph was constructed and installed in the new building. On this instrument spectra can be photographed with very high dispersion and resolution which is essential for the study of complex spectra. The excitation of spectra of astrophysical importance is at present being investigated.

## CHEMICAL PHYSICS

### Vitamin A Determinations

A study was made of the Carr-Price reaction using a recording ultra-violet spectrophotometer. Methods for determining concentration of vitamin A acetate, vitamin A alcohol, C<sub>17</sub> acid and C<sub>17</sub> alcohol were developed.

### Radiometric Methods for Determination of Uranium and Thorium

Radiometric methods were developed for the simultaneous determination of uranium and thorium in milled and leached ores utilizing the beta-radiations, the integrated gamma-radiations above 100 keV, as well as the gamma-radiations in the 2.62 MeV peak of thorium C''. Standardization of these techniques is now taking place with samples which have been accurately analysed by chemical or mass spectrometric methods.



### **Massaspektrometriese Ontledings**

Soos in die verlede is 'n hele aantal roetineontledings gedoen. Die isotoopverduunningsmetode is aangewend om drie ertsmonsters kwantitatief vir uraan en torium te ontleed.

Drie gasmengsels uit warmwaterbronne is ontvang en vir metaan, koolstofoksied, koolstofmonoksied, stikstof, suurstof, waterstof en helium ontleed.

Een lugmonster is in verband met lugbesoedeling in 'n fabriek vir koolstofmonoksied ontleed.

### **Die Ontwikkeling van 'n Massaspektrometer met Krommingstraal van Twee Duim**

Die instrument is oorspronklik in hierdie laboratorium ontwerp, maar die elektroniese toerusting is van 'n handelsfirma verkry. Sekere veranderings moes egter in die elektroniese gedeelte aangebring word voordat die instrument bevredigend kon funksioneer.

Daarna is die instrument oor 'n tydperk van drie maande aan deeglike toetse in ons laboratorium onderwerp.

### **X-straal en Elektron-mikroskopiese Ondersoeke**

Gedurende die afgelope jaar is die X-straalfluoresensie-apparaat opgestel en in gebruik geneem. Vir die uitvoering van kwalitatiewe ontledings het die instrument alreeds met 'n groot aantal identifikasieprobleme doeltreffend gewerk.

Die moontlikhede van die fluoresensie-eenheid as instrument vir kwantitatiewe analise word op die oomblik ondersoek. Die instrument is spesifiek aangepas vir die bepaling van uraankonsentrasies in uraandraende ertse. Die voorlopige resultate is bemoedigend en die vervanging van die huidige Geiger-telbuis deur 'n sintillasiesteller behoort verdere verbetering mee te bring.

Soos in die verlede is X-straaldiffraksiemetodes vir die identifikasie van komponente in komplekse mengsels in toenemende mate toegepas. Fluoresensietoehouere het die reeds kragtige X-straalontledingsmetode nog verder versterk. Dit blyk duidelik uit onlangse werk wat onder kontrak vir 'n industriële firma, wat kalsiumkarbid vervaardig onderneem is. 'n Sistematiese ondersoek van die grondstowwe en die finale produk het moeilikhede, wat vroeër ondervind is, opgelos.

Benewens bogenoemde belangrike langtermynondersoek is talle kleiner ontledings ook uitgevoer.

By studies in verband met sekere mense- en diere siektes is heelwat gebruik gemaak van die elektronmikroskoop vir die fotografering, by hoë vergrotings, van virusse, bakterieë en bakteriefage. Die instrument is ook gebruik om die grootte en vorm van partikels in stof-, katalisator-, kleimonsters te bestudeer.

### **Mass Spectrometric Analyses**

As in the past, a number of routine analyses were made. Three ore samples were standardized for uranium and thorium using isotope dilution methods.

Three gas-mixtures from hot springs were received and analysed for methane, carbon dioxide, carbon monoxide, nitrogen, oxygen, hydrogen and helium.

One air sample was analysed for carbon monoxide in connection with air pollution in a factory.

### **Development of a Two-Inch Radius of Curvature Mass Spectrometer**

For the satisfactory operation of this instrument, originally designed by this Laboratory, certain modifications had to be made to the electrical equipment which was originally supplied by a commercial firm.

The instrument was then thoroughly tested in the Laboratories for a period of three months.

### **X-ray and Electron Microscopic Investigations**

During the past year the X-ray fluorescent apparatus has been assembled and put into use. As a tool for qualitative analytical work, the instrument has already proved its value in a large number of identification problems.

The potentialities of the fluorescent unit as a quantitative analytical instrument is now being investigated. The instrument has been specifically adapted to determine the uranium concentration in uranium bearing ores. Preliminary results have been encouraging and the replacement of the present Geiger counter by a scintillation counter should lead to a further improvement.

As in past years, X-ray diffraction methods for identifying individual compounds in complex mixtures have been used to an ever increasing extent. The availability of a fluorescent attachment has made the X-ray method of analysis even more powerful. This aspect was vividly illustrated during recent work which was undertaken on a contract basis for an industrial firm associated with the manufacture of calcium carbide. A systematic investigation of the raw materials and final products gave the solution to difficulties that had previously been encountered.

In addition to the above major investigations a large number of minor analyses were carried out.

In studies concerned with certain human and animal diseases, the electron microscope was used extensively for the high magnification photography of viruses, bacteria and bacteriophage. The instrument was also used to study the shapes and sizes of the constituent particles in dust, catalyst and clay samples.



### Spektrochemiese Ontleding

'n Matematiese metode om spektrochemiese resultate te vergelyk, is ontwikkel. Die metode berus op die vergelyking van die oppervlaktes van die kontoerellipse rondom die punte in die swartingsverstrooiingsdiagramme. Met behulp van hierdie metode is vasgestel dat indien litiumkarbonaat as buffer by plantasmonsters gebruik word, die mees bevredigende resultate verkry word wanneer die monsters met 'n konstante stroomkragbron opgewek word en die boog deur 'n lugstroom omring is.

Die ontwikkeling van 'n spektrochemiese metode vir die ontleding van smeerolie vir diesellokomotiewe, nader tans voltooiing.

Om die absorpsie van die uraan in harskolomme te beheer, gebruik die myne in Suid-Afrika tans 'n fluoro-metriese of 'n polarografiese metode. Die moontlikheid van 'n spektrochemiese metode as alternatiewe metode is ondersoek. Voorlopige resultate is belowend en verdere navorsing is geregverdig.

'n Elektrodepakmasjien wat op 'n perkussiebeginsel werk is ontwikkel. Die optimum skokfrekwensie, hamergewig en ander werktostande is bepaal. Die uitwerking op die analitiese juistheid, wanneer die elektrodes met 'n masjien in plaas van met die hand gepak word, word tans ondersoek.

'n Studie word tans gemaak van die Feussner vonke as ligbron vir die ontleding van goud in lood. Met behulp van 'n elektroniese tydskakelaar verbind met 'n spektrometer waarop aflesings regstreeks kan geskied, is vasgestel dat „afvonkeffekte” selfs tydens die verloop van die individuele vonke waargeneem kan word.

### SPOORELEMENTNAVORSING

'n Chemiese spoorelementkonsentrasiemetode met behulp van ditisoon, oksien en kupferron is ontwikkel. Hierdie metode maak die skeiding van die spoorelemente in twee of meer groepe moontlik, en 'n mediumdispersie-spektrograaf kan gebruik word om die spoorelemente, sink, nikkell, kobalt, lood, koper, vanadium, molibdeen, mangaan en titaan te bepaal.

By die aanwending van die chemiese konsentrasiemetode vir die bepaling van genoemde elemente in plantmateriaal het geblyk dat die analitiese resultate vir sink die mins geslaagde was. 'n Alternatiewe metode in die direkte bepaling van sink op die plantas, met Zn 2138 as ontledingslyn was ondersoek.

Die meeste fotografiese plate se gevoeligheid neem in die gebiede onder 2,500 Å. weens die absorpsie van die ultraviolet lig deur die gelatien skerp af en gevolglik is pogings aangewend om die plate vir die sinkontledings te sensiteer. Hierdie werk word voortgesit.

### FISIKA VAN DIE VASTE TOESTAND

#### Plastiese Vervorming van Metale

Met die uitgebreide elektron-mikroskopiese studie van plasties vervormde enkelkristalle van alfageelkoper is

### Spectrochemical Analysis

A mathematical method was developed to compare spectrochemical results, by calculating and comparing the areas of the contour ellipses which surround the points of density scatter diagrams. By employing this comparison method it was found that, when using lithium carbonate as buffer for plant ash analysis, the best results were obtained when the samples were excited in a constant current arc with a surrounding air stream.

The spectrographic method being developed to examine lubricating oil of diesel locomotives is now nearing completion.

To control the extraction of uranium in resin columns, the mines in South Africa are at present using either a fluorescent fluorometric or a polarographic method. The possibility of using the spectrographic method as an alternative was investigated. Preliminary results indicate that this is possible and further research is warranted.

An electrode packing machine working on a percussion principle was developed. Optimum bumping frequency, punch weight and other conditions of operations were established. The effect on the analytical accuracy when electrodes are packed with a machine instead of by hand, is being investigated.

A study is being made of the Feussner spark as a light source for analyzing gold in lead. Using electronic time switching with a direct reading spectrometer, it was established that “spark-off” effects occur even during the continuation of the individual sparks.

### TRACE ELEMENT RESEARCH

A chemical trace element enrichment method using dithizone, oxine and cupferron was developed. The scheme allows for the division of the trace elements into two or more groups, and a medium dispersion spectrograph can be used for the analysis of the trace elements zinc, nickel, cobalt, lead, copper, vanadium, molybdenum, manganese and titanium.

The analytical results of zinc in plant materials using chemical enrichment are generally the least satisfactory of the elements listed above. As a possible alternative method the direct determination using Zn 2138 as analysis line was investigated. Owing to the absorption of ultra-violet light by the gelatine, however, the sensitivity of most photographic plates falls off rapidly below 2,500 Å. and special attempts were made to sensitize plates for the zinc analyses. This work is being continued.

### SOLID STATE PHYSICS

#### Plastic Deformation of Metals

An extensive electron microscopic study of plastically deformed single crystals of alpha-brass led to further



verdere kennis opgedoen van die fundamentele afskuiwingsprosesse wat gedurende plastiese vervorming in werking tree. Uit hierdie ondersoek, waarvan die resultate op die konferensie van die „American Institute of Metallurgical and Mining Engineers” in Februarie 1958 voorgelê is, skyn dit of daar ’n korrelasie bestaan tussen die gemiddelde diepte van die afskuiwingslyne en die oriëntasie van die vervormde kristalle.

Vir bogenoemde ondersoek is ’n praktiese bruikbare afdruktegniek ontwikkel waardeur bepaalde gedeeltes agtereenvolgens bestudeer kan word. ’n Artikel waarin hierdie tegniek beskryf word, is vir publikasie ingedien.

#### X-straalverstrooiing onder ’n Klein Hoek

Ten einde die meganisme van korrelverbrokkeling en die ontstaan van vakante atoomposisies en tussenatome tydens die studie van plastiese vervorming, en later ook van stralingsbeskadiging te ondersoek, is ’n kleinhoek X-straalverstrooiingsapparaat ontwerp. Dié apparaat word tans gebou. Die ontwerp behels sekere nuwe, eenvoudige beginsels wat die instrument ’n beraamde oplosvermoë van  $d=2000 \text{ \AA}$  sal besorg.

#### X-straalstudies van Fischer-Tropsch-katalisatore

Die doel van die ondersoek, wat deur Sasol in die vorm van ’n beurs ondersteun word, is eerstens die identifisering van die komponente in ’n katalisator op verskillende stadia van sy aktiwiteit; en tweedens die voorbereidings van suiwer monsters met die doel om ’n fundamentele studie te maak van die verskillende tipes ysterkarbid wat in die katalisatore voorkom.

In verband met bogenoemde is daar noue samewerking met die Nasionale Chemiese Navorsingslaboratorium waar skeikundige ontledings op die katalisatore uitgevoer word. Omdat so min bekend is omtrent die skeikundige eienskappe van die verskillende ysterkarbiede is dit noodsaaklik om hierdie stowwe eers in suiwer vorm voor te berei en om die kristallografie, die eienskappe en vormingstoestande te bestudeer, voordat ’n poging aangewend kan word om te verstaan wat plaasvind in die geval van komplekse korbiedmengsels soos hulle in katalisatore voorkom.

#### Studie van die Fasetransformasie van Legerings

In die verlede is dergelike ondersoek hoofsaaklik op veelkristallyne materiale uitgevoer. Om meer kennis in te win en ook om sekere aspekte soos uitskeiding te bestudeer, is daar besluit om enkelkristalle te ondersoek.

Voordat daar met hierdie ondersoek begin kon word, was dit noodsaaklik om ’n metode te ontwikkel om enkelkristalle met ’n bepaalde oriëntasie voor te berei. Voordat daar na legerings oorgegaan word, is daar met suiwer metale as uitgangspunt ’n eenvoudige en doeltreffende metode ontwikkel waarvolgens die groei van enkel-

information on the fundamental slip processes which come into operation during plastic deformation. From this investigation, the results of which were reported on at the February, 1958, Conference of the American Institute of Metallurgical and Mining Engineers, there appears to be correlation between the average depth of the slip lines and the orientation of the deformed crystals.

For the above investigations the technique of replicating identical areas successively was improved and developed to a point of practical usefulness. A paper describing this technique has been submitted for publication.

#### Low Angle X-Ray Scattering

For studying the mechanisms of grain fragmentation and the formation of vacancies and interstitial atoms during plastic deformation and, at a later stage, during radiation damage studies, a small angle scattering apparatus was designed and is under construction. The design incorporates certain novel and simple features which give the instrument an estimated resolving power of

$$d=2000 \text{ \AA}$$

#### X-Ray Studies of Fischer-Tropsch Catalysts

The objects of this investigation, which is being sponsored by Sasol in the form of a fellowship, are firstly to identify the constituents in a catalyst at various stages of its activity, and secondly to prepare pure samples and obtain fundamental information about the various types of iron carbides which appear in the catalysts. In this project there is close co-operation with the National Chemical Research Laboratory where chemical analyses of the catalysts are in progress. Because so little is known about the chemistry of the various types of iron carbides, it is essential first to prepare these substances in the pure form and to study their crystallography, properties, and conditions of formation before it can be hoped to understand what takes place in the case of the complex carbide mixtures found in catalysts.

#### Phase Transformation Studies of Alloys

In the past, such investigations have been carried out mainly on polycrystalline materials. In order to obtain more information and to study such aspects as precipitations, it has been decided to work with single crystals.

An essential preliminary to the above investigations was the development of a suitable method for growing single crystal specimens of the desired orientation. Starting with pure metals before proceeding to alloys, a simple and efficient method has been developed whereby metal single crystals of a convenient size and suitable



metaalkristalle van gerieflike grootte en oriëntasie aan die gang gesit is. 'n Artikel waarin hierdie metode beskryf word, is vir publikasie ingedien.

#### **Termiese Ontbindingstudies van $\text{AgMnO}_4$**

Die doel van hierdie ondersoek, wat in samewerking met 'n fisiese skeikundige onderneem is, was om vas te stel wat die ontbindingsmeganisme en die eindprodukte van termies ontbonde silwerpermanganaat is.

Voorlopige resultate het getoon dat die ontbindingsmeganisme die kristalrooster nie buitensporig versteur nie. Verder blyk dat die eindprodukte, wat totaal amorf is, waarskynlik nie  $\text{Ag}_2\text{O}$  en  $\text{MnO}_2$  is soos vroeër vermoed nie. Verdere werk oor die identifikasie van die eindprodukte is aan die gang.

#### **Samestellingstudies van Wolframkarbid en Sinkplaat**

Hierdie ondersoek is op kontrakbasis namens twee industriële organisasies onderneem. Gedurende die X-straalstudies van wolframkarbiede, is die ondersoek op die bepaling van die persentasie kobalt in die monsters en die distribusie van wolframkarbiddeeltjies in die kobalttussenmassa, toegespits. Tydens die studies van sinkplaat is die elektronmikroskoop gebruik om uitgeskeide fases in die sinklaag te bestudeer.

#### **Elektronmikroskopiese Studie van Stofdeeltjies**

Die Laboratorium het hierdie ondersoek, ook op kontrakbasis, na 'n breedvoerige ondersoek van die tegnieke in gebruik by die Instituut waar die werk gedoen word, hoofsaaklik in adviserende hoedanigheid onderneem. Die ondersoek vorm deel van 'n veel wyer program van pneumokoniosestudies en die spesifieke stofaspekte wat met die elektronmikroskoop ondersoek word, is die grootte en verspreiding van die stofdeeltjies.

### **KRISTALSTRUKTURE**

#### **1:2:4:5-Tetrabroombenzol**

Die bepaling van die kristalstruktuur van 1:2:4:5-tetrabroombenzol het reeds 'n gevorderde stadium bereik. Die intensiteit van sowat 300 X-straalrefleksies is gemeet, en 'n goeie benadering van die struktuur is met behulp van veralgemeende Patterson-projeksies verkry. Verfyning van hierdie koördinate word nou met behulp van die metode van minimale kwadrate by 'n berekeningsentrum in die V.S.A. uitgevoer. Wanneer die resultate beskikbaar word, sal interessante gevolgtrekkings aangaande die struktuur van hierdie „oorvol” molekule gemaak kan word.

#### **Noukeurige Weissenberg-kamera met Terugrefleksie**

Gedurende 'n navorsingsprogram vir die noukeurige bepaling van die selkonstante van enkelkristalle, is 'n eenvoudige hulpstuk ontwikkel waarmee dit moontlik is om 'n kommersieel beskikbare voorrefleksie-Weissenberg-

orientation have been grown. A paper describing the method has been submitted for publication.

#### **Thermal Decomposition Studies of $\text{AgMnO}_4$**

The object of this investigation, undertaken in collaboration with a physical chemist, was to determine decomposition, mechanism and the end products of thermally decomposed silver permanganate.

Preliminary results have shown that the decomposition mechanism does not stress the crystal lattice unduly. Furthermore, the end products, which are in a truly amorphous state, are probably not  $\text{Ag}_2\text{O}$  and  $\text{MnO}_2$  as was hitherto suspected. Further work on the identification of the end products is in progress.

#### **Composition Studies of Tungsten Carbide and Galvanized Iron**

These investigations were undertaken on contract for two industrial concerns. During X-ray studies of the cemented carbides, interest was centred around the percentage cobalt and the carbide distribution in the cobalt matrix. In the galvanized iron studies the electron microscope was used to detect and study precipitated phases in the galvanized layer.

#### **Electron Microscopic Study of Dust Particles**

This investigation was also undertaken on a contract basis and this Laboratory acted largely in an advisory capacity after a thorough survey had been made of the techniques adopted at the Institute where the work is being done. The investigation forms part of a much wider programme of pneumoconiosis studies and the specific dust aspects studied with the electron microscope are those of particle size and particle distribution.

### **CRYSTAL STRUCTURES**

#### **1:2:4:5 Tetra-bromo Benzene**

The determination of the crystal structure of 1:2:4:5 tetra-bromo benzene is at an advanced stage. The intensities of some 300 X-ray reflections have been measured and a good approximation to the structure has been obtained from generalized Patterson projections. Least squares refinement of the atomic co-ordinates thus obtained is now in progress at a computing centre in the United States. When these results shortly become available it should be possible to make interesting deductions as to the atomic arrangement in this “overcrowded” molecule.

#### **Precision Back Reflection Weissenberg Camera**

During a programme of determining accurately single crystal lattice parameters, a simple attachment was developed for converting a commercially available front reflection Weissenberg camera into a back reflecting



kamera in 'n terugrefleksie-instrument van hoë noukeurigheid om te skakel. Besonderhede van die ontwerp is gepubliseer. 'n Buitelandse firma het te kenne gegee dat hulle belang stel in die vervaardiging van 'n Weissenbergkamera wat hierdie ontwerp eienskappe behels.

#### Molekulêre gewigte van Kukurbitasiene

Die molekulêre gewigte van komplekse verbindings kan noukeurig bereken word indien noukeurige metinge van die kristalselfkonstantes en digthede van kristalle uitgevoer word. In die afgelope jaar is hierdie metode aangewend om die korrekte molekulêre gewigte van 'n aantal kukurbitasiene, waaroor daar tot dusver onsekerheid was, te bepaal.

#### Sentrosimmetriese Molekules in Nie-Sentrosimmetriese Ruimte-groepe

Die bepaling van die kristalstruktuur van 4:4'-dinitrodifeniel het die seldsame verskynsel van 'n sentrosimmetriese molekule wat in 'n nie-sentrosimmetriese ruimtegroep kristalliseer aan die lig gebring. Omdat dit slegs die tweede bekende voorbeeld van so 'n gebeurlikheid was, is besluit om die ruimtegroepbepaling te herhaal.

Hierdie latere ondersoek het die resultate wat vroeër verkry is, volledig bevestig. Teoretiese ondersoek is daarna ook in verband met molekule met meer as een simmetriesenter onderneem. Die invloed van sodanige nie-kristallografiese molekulêre simmetrie op die intensiteitsdistribusie van die X-straalrefleksies is vasgestel. Die resultate van hierdie ondersoek wat gepubliseer is, het bewys dat die intensiteitsstatiekmetode wat algemeen aangewend word vir die vasstelling van simmetriesentra in kristalle in die vervolgsigtig gebruik moet word wanneer die molekule self 'n hoë simmetrie besit.

#### Trimetielsteroïde

Die ruimtegroep, eenheidselkonstantes en X-straalintensiteite van die belangrikste kristalvlakke is vir drie trimetielsteroïde vasgestel. Volgens die resultate, wat reeds gepubliseer is, is drie verbindings stereoisomeries. Hierdie gegewens kan dien om voortaan soortgelyke strukture te identifiseer.

### GEOFISIKA

#### Nuwe Swaarekragbepalings aan die Suid-Afrikaanse Basisstasies

In die tydperk September tot Desember 1956, is waarnemings van swaartekrag met die pendulumapparaat van die Departement van Geodesie en Geofisika, Universiteit van Cambridge gedoen aan die Britse swaartekragbasis te Teddington en die Suid-Afrikaanse basisstasies te Mowbray, Johannesburg en Pretoria. Die doel van die werk was om opnuut 'n verbinding van Suid-Afrikaanse

instrument of high precision. Details of the design have been published and an overseas manufacturing firm has expressed interest in the manufacture of a Weissenberg camera incorporating this design.

#### Molekular Weight of Cucurbitacins

Precision lattice parameter measurements, together with accurate determinations of density, make possible the accurate evaluation of the molecular weights of complex substances. This method has, during the past year, been used to determine the correct molecular weights of a number of cucurbitacins about the composition of which there was a good deal of uncertainty in the past.

#### Centrosymmetric Molecules in Non-Centrosymmetric Space Groups

The complete structural determination of 4:4'-dinitrodiphenyl has afforded a rare example of a centrosymmetric molecule crystallizing in a non-centrosymmetric space group. Because this was only the second known case, it was decided to re-examine the space group previously assigned.

Further work on this compound has fully confirmed the earlier results. A theoretical investigation has been extended to cases where the molecules have more than one symmetry centre. The influence of such non-crystallographic molecular symmetry on the intensity distribution of the X-ray reflections has been established. The results of this investigation, which have been published, have shown that the much used intensity statistics method for detecting crystallographic centres should in future be used with caution when the molecules themselves possess a high degree of symmetry.

#### Trimethyl-Steroids

The space group, unit cell dimensions and the X-ray intensities of the major reflecting planes for three trimethyl-steroids have been determined. The results, which have been published, show the three compounds to be stereoisomeric. From these data future structures resembling these could be characterized.

### GEOPHYSICS

#### New Determination of Gravity at the South African Base Stations

Between September and December, 1956, gravity observations were made with the pendulum apparatus of the Department of Geodesy and Geophysics, University of Cambridge, at the British gravity base at Teddington and at the South African base stations at Mowbray, Johannesburg and Pretoria. The purpose of the work was to make a new connection of the South



swaartekragbasisse met die internasionale swaartekrag-netwerk in te stel. Die finale waarnemings te Teddington is deur geofisici van Cambridge uitgevoer en hierdie data is nog nie ontvang nie. Tot tyd en wyl dit ontvang word, kan die werk nie vir publikasie voltooi word nie.

## MAGNETISME VAN ROTSE

Die belangrikste en interessantste aspekte van die paleomagnetiese studie van rotse, is die data wat verkry word oor die geskiedenis van die aarde se magnetiese veld en die verwante probleme van die aardpoolverandering en vastelandse drywing.

### Palaeomagnetiese Studie van die Pilansberggange

Die rotsmagnetisme van die basiese dele van vyf pilansberggange waarvan monsters geneem is in goudmyne, dui op 'n magnetiese Noordpool in Etiopië tydens afkoeling van hierdie gange. 'n Petrografiese studie van hierdie gange dui daarop dat opeenvolgende intusies van magma blykbaar in twee gange plaasgevind het. In die ander gange is metasomatiese veranderings van minerale waarskynlik verantwoordelik vir die wisseling in tekstuur en samestelling wat waargeneem is.

Dr. Schreiner van die Bernard Price-Instituut het goedgegunstiglik onderneem om ouderdomsbepalings ten opsigte van drie monsters van die Robinson-gang uit te voer, deur van biotietverrykte fraksies van die gesteente gebruik te maak. Vir die drie monsters is 'n gemiddelde ouderdom van  $1290 \pm 180$  miljoen jaar vasgestel. Die gemelde onsekerheid is die 99 persentige sekerheidsgrens. Die verskaffing van 'n tydgrens vir die intrusie van die Pilansberggange verhoog die waarde van die palaeomagnetiese gegewens in aansienlike mate.

### Bou van 'n Nuwe Elektromagnetiese Rotsmagnetometer

Hierdie instrument is reeds voltooi en in gebruik geneem. Die rotsmonster draai in 'n druklugturbine („tol”) wat van dieselfde tipe as dié in die prototipe-magnetometer van die Geofisiese Afdeling en in die magnetiese kragmeter van die Bernard Price-Instituut is. Die „tol” is groot genoeg gemaak om 'n silindriese rotsmonster  $1\frac{3}{8}$  duim in deursnee te bevat. Monsters van boorgatkerns van standaardgrootte kan dus daarmee gemeet word. 'n Verbeterde montering ontwerp deur mnr. Keiler van die Bernard Price-Instituut gee uitstekende akoestiese isolasie. 'n Reghoekige spoel met kompensasiewikkeling verbeter die sein-geraasverhouding en hou met sy lae impedansie resonerende frekwensies weg van die werkfekwensie. Die spoel word deur 'n geskikte verhogingstransformator aan die eerste rooster gekoppel. Verbeterde elektrostatiese beskerming word deur die gebruik van bladtin verseker. Die hele samestel van spoel en turbine werk binne in 'n vierkantige staalkassie wat aan twee kante oop is. Dit beperk verstorende harmoniese

African gravity bases with the international gravity network. The closing observations at Teddington were made by Cambridge geophysicists and the data have not yet been received. Until they are received it is impossible to complete the work for publication.

## PALAEOMAGNETISM

The main interests of palaeomagnetic studies lie in the data they yield concerning the history of the earth's magnetic field and the related problems of polar wander and continental drift.

### Palaeomagnetic Study of the Pilansberg Dykes

The palaeomagnetism of the basic parts of five Pilansberg dykes, sampled in gold mines, indicates a north magnetic pole in Ethiopia at the time of cooling of these dykes. A petrological study of the dykes has been continued and it has been found that in two of the dykes double intrusion has apparently taken place, whereas in others it is possible that metasomatic alteration could account for the observed variations of texture and composition.

Dr. Schreiner of the Bernard Price Institute kindly undertook age determination on three samples from the Robinson Dyke, using biotite-enriched fractions, and these give a mean age of  $1290 \pm 180$  million years. The uncertainty quoted is the 99 per cent confidence limit. The provision of a date for the intrusion of the Pilansberg dykes greatly increases the value of the palaeomagnetic datum.

### New Rock Magnetometer of Electromagnetic Type

This instrument has been completed and is in use. The rock specimen is rotated in a compressed air turbine (“top”) of the same type as those used in the Geophysics Division's prototype magnetometer and in the Bernard Price Institute's magnetometer. The “top” has been made large enough to take cylinders of rock  $1\frac{3}{8}$  inch in diameter so that pieces cut from standard bore-core can be measured. An improved mounting designed by Mr. Keiller of the Bernard Price Institute gives excellent acoustic isolation. A rectangular coil with tapped compensating winding improves the signal to noise ratio, and is of low impedance to keep resonant frequencies well away from the working frequency. The coil is coupled to the first grid through a suitable step-up transformer. Improved electrostatic shielding is secured by using tinfoil. The whole coil-turbine assembly is operated inside a square-section open ended steel box, which reduces to a low level mains harmonic pickup. The amplifier is symmetrical. A new arrangement is used for phase



effekte van die hoofkraglyn tot 'n lae peil. Die stroomversterker is simmetries. Die rangskikking vir fase-opsporing is volgens 'n nuwe model wat gebaseer is op 'n ontwerp deur Clarkson en La Coste vir 'n swaartemeter vir gety-registrasie. Die magnetiese kragmeter word gereeld gebruik en skyn bevredigend te werk. Die minimale grens vir metings is 'n magnetiese moment van omtrent  $4 \times 10^7$  c.g.s. e.m.u. wat ooreenstem met 'n intensiteit van magnetisme van  $3 \times 10^{-8}$  gauss in 'n silinder van 1 duim  $\times$  1 duim of met  $1 \times 10^{-8}$  gauss in 'n silinder van  $1\frac{1}{8}$  duim  $\times$   $1\frac{1}{8}$  duim.

#### Palaeomagnetiese Studie van die Bosveldstollingskompleks

Georiënteerde monsters van die basiese gedeelte van die kompleks is op die volgende plekke verkry: gabbromonsters van 'n damterrein naby Rossenekal; monsters van pirokseniet uit die Groothoekchroommyn op die noord-oostelike grens van die norietkom, en uit die Swartkopchroommyn op die noord-westelike flank geleë; monsters van anortosiete ondergronds uit die myn en van pad-deurgrawings naby die Swartkopchroommyn. Die gabbromonsters van Roossenekal toon uitstekende bestendigheid in die rigting van natuurlike remanente magnetisasie. Saam beskou met die resultate verkry uit die hoofgabbrosone by Bon Accord, dui dit daarop dat die gesteente gemagnetiseer was voordat plooiing van die kors ontstaan het; dat die magnetisasie sedert korsdeformasie stabiel was en dat die magnetiese Noordpool tydens afkoeling en konsolidasie van die gabbro in Noord-Afrika moes gelê het. Die pirokseniete van Swartkop is magneties baie swak en toon geen rigtingsbestendigheid nie. Die monsters uit Groothoek is nog nie gemeet nie. Die voorlopige aanduidings gegrond op resultate van monsters van Bon Accord en Roossenekal af moet die onderwerp van verdere ondersoek vorm. Dit is veral wenslik om indien moontlik, pasblootgestelde, onverweerde gesteente uit die hoofgabbrosone aan die westelike vleuel van die Bosveldkom te verkry.

#### Onderzoek van die Natuurlike Remanente Magnetisering van die Witwatersrandkwartsiete

Uit georiënteerde handmonsters van kwartsiete wat deur 'n mynmaatskappy verskaf is, word kerns geboor. Meting van die monsters sal binnekort 'n aanvang neem. Die doel van die ondersoek is om uit te vind of die kwartsiete 'n konstante magnetiseringsrigting besit, wat van nut kan wees om boorgatkerns te oriënteer.

### GEOCHRONOLOGIE

#### Ouderdomsafwykings

Die studie van die Bosveldsirkone is afgehandel. Die ouderdom van hierdie sirkone word op  $1850 \pm 150$  miljoen jare gestel. 'n Posing is aangewend om te bewys dat die diffusie van radiogene lood die oorsaak van die ouderdomsafwykings is, maar die resultate is nie oor-

detection, based on a design used for a tidal recording gravimeter by Clarkson and La Coste. The magnetometer is in regular use and appears to be a satisfactory instrument. The lower limit for measurement is a magnetic moment of about  $4 \times 10^7$  c.g.s. e.m.u., which corresponds to an intensity of magnetization of  $3 \times 10^{-8}$  gauss in a cylinder 1 in.  $\times$  1 in. or to  $1 \times 10^{-8}$  gauss in a cylinder  $1\frac{1}{8}$  in.  $\times$   $1\frac{1}{8}$  in.

#### Palaeomagnetic Study of the Bushveld Complex

Oriented specimens of gabbro have been secured from a dam site near Roossenekal, of pyroxenite from Groothoek Mine in the north-eastern limit of the norite basin, of pyroxenite from underground and of anorthosite from a road cutting at Swartkop Mine in the north-western limb. The gabbro specimens from Roossenekal show excellent consistency in the direction of natural remanent magnetization and, taken together with the results from the gabbro from Bon Accord, suggest that the magnetization was acquired before the crustal down-warp developed; that the magnetization has been stable since the crustal deformation, and that the North magnetic pole was in North Africa when the gabbro cooled. The pyroxenite from Swartkop is very weakly magnetized and shows no consistency in direction. The Groothoek specimens have still to be measured. The provisional suggestions made on the basis of the work on the Bon Accord and Roossenekal specimens must be the subject of further investigation. In particular it is desirable to secure an exposure of fresh gabbro of the main gabbro zone from the western limb, if this is possible.

#### Study of the Natural Remanent Magnetization of the Witwatersrand Quartzite

Cores are being drilled from oriented band-specimens provided by a mining group. Measurement of these will commence shortly. The aim of the work is to discover whether the quartzite possesses any consistent direction of magnetization which might be of use in orienting bore-cores.

### GEOCHRONOLOGY

#### Age Discrepancies

Work on the Bushveld zircons was completed. The age derived for these zircons was  $1850 \pm 150$  million years. It was attempted to prove that diffusion of radiogenic lead was the cause of age discrepancies, but the results were inconclusive. Radon loss was disproved, and it is



tuigend nie. Daar is egter bewys dat radonverlies ook geen verklaring bied nie. Besmoontlik het die hoë persentasie primêre lood in die sirkone die grootste invloed op die berekende ouderdomme.

Die studie van die geskiktheid van monasiete vir ouderdomsbepalings is voortgesit en vyf addisionele monsters is ontleed. Drie monsters is afkomstig van 'n pegmateit naby Kakamas, een van Mt. Darwin in Suid-Rhodesië en 'n vyfde, radio-aktiewe monster van Alto Ligonha in Portugees Oos-Afrika.

#### **Ouderdomsbepalings ten opsigte van Suid-Afrikaanse Minerale**

Drie addisionele monsters uit die Damara-sisteem in Suidwes-Afrika is ontleed. Hiermee is die studie van dié sisteem voltooi. Die waarskynlikste ouderdom van die radioaktiewe minerale in hierdie sisteem kan op  $530 \pm 50$  miljoen jare gestel word.

Die strontiumisotoopverhoudings van vyf monsters is in verband met ouderdomsbepalings aan die Bernard Price-Instituut vir Geofisiese Navorsing bepaal.

Een monster radioaktiewe mineraal is vir die Geologiese Opname van Swaziland ontleed.

Die isotoopverhouding van 23 galenamonsers van die Witwatersrand-sisteem en die Transvaalsisteem is bepaal. Hierdie navorsing is ter uitbouing en ondersteuning van die ouderdomsbepalings op minerale uit die Bosveldstollingsgesteente en die Witwatersrand-sisteem onderneem.

#### **Veldwerk**

Twee studiereise is in samewerking met die Geologiese Opname onderneem. Die hoofdoel was om W.N.N.R.-personeel vertrou te maak met die wyse waarop geologiese probleme aangepak word en om nouer samewerking tussen geoloog en fisikus te bewerkstellig.

Verskeie monsters is versamel en waardevolle onder-vinding opgedoen.

#### **ATMOSFERIESE FISIKA**

Die bepaling van radioaktiewe neerslag wat op atoom-bomtoetse volg word nog gereeld gedoen. Die skema is uitgebrei sodat daar op die oomblik nege waarneming-stasies is, wat onder Marion-eiland en Tristan da Cunha, 'n Outomatiese telapparaat, wat tien monsters agter-eenvolgens kan „tel”, is ontwikkel. 'n Verslag van die omvang van radioaktiewe neerslag in Suid-Afrika is aan die „United Nations Scientific Committee on the Effects of Atomic Radiation” gestuur. Verder word noue same-werking met die organisasie vir die Internasionale Geofisiese Jaar gehandhaaf, aangesien inligtings in verband met radioaktiewe neerslag by die ondersoek van lugstrominge om die aardbol belangrik is.

believed that the large proportion of primary lead in the zircons had the greatest effect on the calculated ages.

The study of the suitability of monazites for age determinations was continued and five additional samples were analysed. Three were obtained from a pegmatite near Kakamas, one from Mt. Darwin in Southern Rhodesia and one from Alto Ligonha in Portuguese East Africa.

#### **Age Determinations on South African Minerals**

Three additional samples from the Damara system in South West Africa were analysed, thus completing the study on this system. The most probable age for the radio-active minerals in this system can be given as  $530 \pm 50$  million years.

The strontium isotopic ratios of five samples were measured in connection with age determination by the Bernard Price Institute for Geophysical Research.

One sample of a radioactive mineral was analysed for the Geological Survey of Swaziland.

Altogether 23 galena samples from the Witwatersrand and Transvaal systems were analysed. This work was undertaken in order to substantiate the results of age determination on minerals from the Bushveld Igneous Complex and the Witwatersrand system.

#### **Field Work**

Two field trips were made in collaboration with the Geological Survey. This was done mainly to acquaint C.S.I.R. personnel with geological problems and to establish closer liaison between the geologist in the field and the physicist.

Several samples were collected and valuable experience was gained.

#### **ATMOSPHERIC PHYSICS**

The regular determination of radio-active fall-out from atom bomb tests was continued and the number of stations was extended to include Marion Island and Tristan da Cunha so that recordings are now made at nine stations. An automatic counting instrument for measuring ten samples consecutively was developed. A report on the measurements of radio-active fall-out in South Africa was sent to the United Nations Scientific Committee on the Effects of Atomic Radiation. Close co-operation is also maintained with the International Geophysical Year organization seeing that information on radio-active fall-out is of importance in studying global air movements.



Hierdie werk word uitgebrei om die natuurlik radio-aktiwiteit in die menslike omgewing te omvat.

### **Lugbesoedeling**

Gedurende 1957 het die werksaamhede in verband met die meet van lugbesoedelingskonsentrasies in Pretoria sy derde jaar ingegaan. Twee pamflette oor gevolgtrekkings wat uit die waarnemings gemaak kan word, is gepubliseer.

Navorsing gedurende die vorige twee jaar het aangetoon dat die aard van lugbesoedeling op die oostelike grens nie merkbaar verskil van dié op die westelike grense in die ou gedeelte van die stad nie en gevolglik is twee lugtoets-apparate, oor die rantjies wat Pretoria in 'n noordelike en suidelike gedeelte verdeel, verskuif ten einde inligtings oor die nuwe noordelike deel van die stad te verkry. Hierdie werk word nog voortgesit.

Die Wêreldgesondheidsorganisasie het die hoof van die Afdeling Algemene Fisika versoek om hom ook te laat inskryf op die lys deskundiges op die gebied van omgewingshigiëne. Hy is genooi om 'n komiteevergadering van deskundiges in Geneva by te woon om 'n verslag uit te bring oor die kennis wat tans oor lugbesoedeling beskikbaar is en om te besluit watter houding die ledestate van die Wêreldgesondheidsorganisasie daaromtrent moet inneem. Verder is die hoof van die Afdeling Algemene Fisika versoek om 'n verhandeling getitel „An Historical Review of Atmospheric Pollution”, vir oorweging deur hierdie komitee, op te stel.

Hierdie pamflet word met twaalf ander deur die Wêreldgesondheidsorganisasie as handboek oor lugbesoedeling vir die gebruik van sy ledestate gepubliseer.

### **Rukwinde deur Vliegtuie Aangetref**

Verdere inligtings oor rukwinde deur Skymaster-vliegtuie aangetref is gedurende die jaar verkry en met waarnemings van 'n Dakotavliegtuig verkry, saamgevat vir publikasie. Hierdie inligtings word vrygestel ter bepaling van die moontlike gebruiksduur voordat vermoënis intree van die hoofvlerkspaar van 'n nuwe soort vliegtuig wat onlangs in die Unie in gebruik geneem is.

'n „Versnellingsmeter” is van die Aircraft Research Establishment in Engeland geleen en in 'n Shackleton-vliegtuig geïnstalleer, wat gedurende die Internasionale Geofisiese Jaar lang vlugte van Kaapstad na die Verre Suide aflê. Op hierdie wyse kan inligtings in verband met lugturbulensie ingewin word op 'n gebied wat tot dusver nog nie bestudeer is nie.

### **Moontlike invloed van Meteorietstof op Reënval**

Daar is aan die hand gedoen dat 'n verband bestaan tussen die hoë reënval op sekere datums by talle meetstasies en die sterrereëns wat sowat 'n maand vroeër plaasvind. Hierdie verband sou verstaanbaar wees indien deeltjies meteorietstof wanneer hulle tot wolkhoogte val as uiters doeltreffende „vrieskerns” optree en sodoende

This work is now being extended to cover all natural radio-activity in the human environment.

### **Air Pollution**

During 1957, the work on the measurement of pollution concentrations in Pretoria reached its third year. Two papers were published on the deductions to be drawn from observations.

As the observations over two years had indicated that the general behaviour of the pollution in the older portion of Pretoria did not vary significantly from the western boundary of the city to the eastern boundary, two of the sampling stations were moved across the line of hills which divide the city into a northern and southern half so as to obtain information about conditions in the newer northern section of the city. This work is proceeding.

The World Health Organization invited the head of the General Physics Division to become a member of its panel of experts on environmental sanitation. He was requested to attend a committee of experts which met in Geneva to draw up a report on the present state of knowledge about air pollution and the policy which member states of the World Health Organization should adopt in this regard. For the consideration of this committee, the World Health Organization also asked the head of the General Physics Division to prepare a paper on “An Historical Review of Atmospheric Pollution”. This paper, with twelve others is being published by the World Health Organization as a monograph handbook on air pollution for the use of member countries.

### **Gusts Experienced by Aircraft**

Further records of gustiness in Skymaster Aircraft of the South African Airways were obtained during the year. This information combined with that obtained from the Dakota observations has been written up for publication. The information has been made available to enable an assessment to be made of the probable fatigue lifetime of the main wing spar of a new type of aircraft, which has recently begun service in South Africa.

A “counting accelerometer” was obtained on loan from the Aircraft Research Establishment in England, and was installed in the Shackleton aircraft making flights to the Far South from Cape Town during the International Geophysical Year. In this way information will be obtained about air turbulence in an area which up to now had not been studied.

### **Possible Influence of Meteorite Dust on Rainfall**

It has been suggested that rainfall peaks on certain dates at many observation stations are linked with the occurrence of meteorite showers about 30 days previously. This connection could be accounted for if particles of meteorite dust acted as particularly efficient “freezing



help om waterdruppels te bevries en tot reëndruppel-grootte te laat aangroei.

Verdere metings van die konsentrasie van atmosferiese vrieskerns is hierdie somer as deel van 'n wêreldwye toets van die meteorietstofteorie uitgevoer. Metings wat by Swakopmund, S.W.A. uitgevoer is, het hoë konsentrasies op 'n paar datums gegee, wat nie eintlik òf met die teorie òf met die vorige jaar se resultate ooreenstem nie. Volgens die metings by Pretoria het hoë tellings op al die verwagte datums en nog 'n paar ander datums voorgekom. Resultate word met dié van ander lande vergelyk.

#### **Navorsing in verband met die Ontwikkeling van Cumuluswolke**

Onderzoek van die groeiproses van cumuluswolke is hierdie somer begin. Die hoogtes van ontwikkelende wolktoerings is bepaal deur middel van twee toedoliete op die ente van 'n afgemete basislyn. Die hoogte en temperatuur waarop hulle voorkom bepaal die veranderings in die voorkoms van die wolke wat byvoorbeeld, die ontstaan van yskristalle aandui. Op hierdie wyse sal hopelik 'n vollediger beeld van die proses van reënvorming in wolke oor die hoëveld verkry word.

Die 3-cm-radartoestel is opgeknop en sal gebruik word om verdere inligtings te gee oor die aan- of afwesigheid van groot waterdruppels of yskristalle in die wolke wat waargeneem word.

### **OPTIKA**

#### **Lensontwerp**

Die keuse van die geskikste glassoorte by die ontwerp van lense van hoë gehalte het hoofsaaklik berus op gissings en vergissing. Uit navorsing in verband met die keuse van glas is 'n metode ontwikkel waarvolgens die geskikste glas of glassoorte vir bepaalde lenstipes sistematies gekies kan word. Twee artikels is oor hierdie werk vir publikasie opgestel.

#### **Interferensiemetodes**

Die vervaardiging van meerlagige diëlektriese filters vir gebruik in die ultravioletgebied is bestudeer. Hierdeur is die reeds geslaagde werk in verband met filters vir die sigbare gebied van die spektrum verder gevoer. Tot dusver is geen geskikte metode gevind nie.

#### **Spektroradiometriese Onderzoek van Daglig**

'n Spektroradiometriese ondersoek van daglig in verband met die Internasionale Geofisiese Jaar is te Pretoria begin met die oog op die bepaling van die relatiewe verdeling van spektraalenergie in daglig van die ultraviolet tot die nabye infrarooi. Die nodige instrumente is gemonteer en getoets maar die eksperimentele werk is nog in die aanvangstadium.

nuclei" on falling to cloud level, thereby causing freezing of water droplets and their growth to raindrop size.

Further measurements of the concentration of atmospheric freezing nuclei were made this summer as part of a world-wide test of the meteorite dust theory. Observations carried out at Swakopmund, S.W.A., gave high counts on a number of dates, which, however, agreed neither with the theory nor with the previous year's results. The measurements at Pretoria showed high counts on or near all the expected dates and on several additional occasions. The results are now being studied and compared with those obtained in other countries.

#### **Studies of Development of Cumulus Clouds**

An investigation of the process of growth of cumulus clouds was commenced this summer. The heights of developing cloud towers are determined using two theodolites at the ends of a measured baseline. Changes in appearance of the clouds indicating, for example, the formation of ice crystals, are related to the height and temperature at which they occur. In this way it is hoped to get a more complete picture of the process of rain formation in clouds over the highveld.

A 3-cm radar set has been reconditioned and will be used to provide additional evidence of the presence or absence of large water drops or ice crystals in the clouds under observation.

### **OPTICS**

#### **Lens Design**

In the design of high quality lenses the choice of the most suitable glasses has been largely a question of trial and error. Research into the choice of glasses has led to a method in which the most suitable glass or glasses for certain types of lenses can be selected systematically. Two publications have been prepared.

#### **Interference Methods**

The manufacture of multi-layer dielectric filters suitable for use in the ultra-violet has been studied. This is an extension of the successful work on filters for the visible part of the spectrum. Up to the present no suitable method has been found.

#### **Spectroradiometric Investigation of Daylight**

In connection with the International Geophysical Year a spectroradiometric investigation of daylight at Pretoria has been initiated. The aim is to determine the relative spectral energy distribution of daylight from the ultra-violet to the near infrared. The necessary instruments have been assembled and tested but experimental work is still in the preliminary stage.



### Die Studie van Glans

Die goniofotometer, gebou in die W.N.N.R.-werkplaas, is finaal gemonteer en getoets. Die instrument is besonder geskik vir die studie van die glans en verwante eienskappe van stowwe.

Navorsingswerk in 'n oorsese laboratorium gedoen, het 'n tentatiewe absolute skaal tot gevolg gehad waarvolgens die glans van stowwe gemeet kan word.

### Optiese Diens

Heelwat optiese diens is aan laboratoriums van die W.N.N.R.—regerings- en privaats navorsingslaboratoriums, universiteite en privaats persone gelewer. Hierdie diens het onder andere die volgende ingesluit: navrae in verband met die hitte- en ligdeurlating van dakmateriale die meting daarvan, die ontwerp van 'n spesiale vloeistoffilter, die meting van kleure, vervaardiging van optiese onderdele soos prisma's, lense, spieëls, optiese platte en absorpsiefilters.

## FISIKA VAN MATERIE

### Vasstelling van die mate en graad van kraging in mynrotswande

Rotsstortings is 'n ernstige vraagstuk wat aan mynwerk op groot diepte op die Witwatersrand verbonde is. Daar word tans algemeen aanvaar dat die waarskynlikheid van sulke rotsstortings baie nou saamhang met die mate waarin die rotswand ontspan of gekraak is. In 'n poging om die graad van kraging van rotswande te bepaal, het die laboratorium soniese en ultra-soniese metodes ontwikkel. Hierdie werk word in samewerking met die Nasionale Navorsings-instituut vir Meganiese Ingenieurswese uitgevoer.

Die twee soniese metodes wat ontwikkel is, is deeglik getoets. Die gevolgtrekkings was dat die metode van „tydsvertraging langs die oppervlakte” onbetroubaar is en tot foutiewe resultate lei. Die metode van „tydsvertraging in diepte” lewer daarenteen, meer betroubare inligtings nie alleen ten opsigte van die diepte van die gekraakte gebied nie maar ook ten opsigte van die graad van kraging binne die sone.

'n Artikel getitel „Determination of the extent of fracture of rock faces by sonic means” is vir publikasie opgestel.

Metodes word ondersoek om die toerusting wat ondergronds gebruik word, te vereenvoudig. Toerusting vir hierdie doel vervaardig, word tans getoets.

Om die optimum frekwensie vir gebruik by die ultra-soniese weerkaatsingsmetode te bepaal, is die verswakking en die snelheid van klankgolwe as funksie van frekwensie en druk bepaal. Dit het geblyk dat krake wat deur 'n druk van meer as 5,000 pond per vierkante duim „gesluit” is, by 'n frekwensie van etlike honderde kiloherz nog waargeneem kan word.

### The Study of Gloss

The goniofotometer which was built in the C.S.I.R. Workshops was finally assembled and tested. The instrument is eminently suitable for the study of gloss and related characteristics of materials.

Research work carried out in an overseas research laboratory has led to a tentative absolute scale of gloss according to which the gloss of materials can be measured.

### Optical Services

A relatively large volume of optical services was rendered to laboratories of the C.S.I.R., government and private research laboratories, universities and private individuals. These services included the following: consultation on and measurement of heat and light transmission through roofing materials; the design of a special liquid filter; the measurement of colours; manufacture of optical components like prisms, lenses, mirrors, optical flats and absorption filters.

## PHYSICS OF MATTER

### Determination of the Extent and Degree of Fracture of Rock Faces in Mines

A very serious problem associated with mining at depth on the Witwatersrand is the occurrence of rockbursts. It is now generally accepted that the likelihood of a rockburst is closely related to the extent to which the rock face is distressed or fractured. Sonic and ultrasonic methods were developed in this laboratory in an effort to determine the extent of fracture of rock faces. This work is being done in collaboration with the National Mechanical Engineering Research Institute.

The two sonic methods developed were thoroughly tested and the conclusion was reached that the time-delay-along-the-surface method was unreliable and led to erroneous results. The time-delay-in-depth method gives more reliable information, not only on the depth of fracture zone, but also on the degree of fracture within the zone.

An article, “Determination of the Extent of Fracture of Rock Faces by Sonic Means” was prepared for publication.

Methods are being investigated for simplifying the equipment to be used underground. Equipment constructed for this purpose is being tested.

In order to determine the optimum frequency for the ultrasonic reflection method, the attenuation and the velocity of sound were measured as a function of frequency and pressure. It was found that, at a frequency of several hundred kilocycles per second, cracks “closed” by stresses of more than 5,000 pounds per square inch could also be detected.



Om 'n reflektoskoop vir ondergrondse ondersoek aan te pas moes 'n nuwe metode en bykomstige apparaat ontwikkel word. Dit word beskryf in 'n artikel „An Ultrasonic Reflectoscope with Indicator of the Degree of Coupling between Transducer and Object” wat die Journal of the Acoustical Society of America vir publikasie aangeneem het. Hierdie artikel wys daarop dat die vervorming van 'n radiofrekwensie-impuls, deur die omsetter voortgebring 'n funksie van die koppeling tussen omsetter en voorwerp is. As gevolg hiervan kan die vervorming gebruik word om die koppelingsgraad te bepaal. Die verval-ent van die impuls word deur 'n tydselektiewe versterker versterk, gelykgerig en op 'n galvanometer oorgelê. Verskeie koppelingsomstandighede word ontleed. Verwysingsrefleksies soos dié van grensvlakke af is derhalwe nie langer by nie-vernietigende toetse nodig nie.

Metings in die myne uitgevoer, bevestig dat die ondersoekte volume dié is van 'n silinder van 10 voet deursnee rondom die toetsgat wat in die rotswand geboor word.

Die omvang van die gekraakte gebied is bepaal en blykbaar maak hierdie metode dit moontlik om tussen 'n gekraakte, gedeeltelik gekraakte en 'n ongekraakte gebied te onderskei.

Die resultate deur metings ter plaatse verkry is vergelyk met 'n ontleding van die kernmonsters wat verkry is met 'n ander model van dieselfde toerusting. Die twee metodes lewer dieselfde resultaat op.

#### **Voortplanting van Skokgolwe in Halfoneindige Media**

Die voortplanting van skokgolwe deur 'n halfoneindige medium, wanneer die oppervlakte van die medium met 'n hamer geslaan word, is vir seismologiese werk op ondergrondse rotsmassas en vir seismiese ondersoek oor kort afstande in grond op die oppervlakte van belang.

Ekperimente wat op die W.N.N.R.-terrein te Brummeria uitgevoer is, het aangetoon dat 'n skerp impuls ook werklik uitgerek word wanneer dit langs die grondoppervlak voortgeplant word, en dat die resultate goed met Ricker se teorie ooreenstem. Dit het gebyk dat die elastisiteitskonstante van die medium van die metings verkry kan word. Verdere metings word tans uitgevoer om die voorlopige resultate te bevestig.

#### **Vibrasie van spoorstawe**

Die dinamiese kragte wat in 'n spoorstaaf optree wanneer 'n trein daaroor loop, kan die statiese kragte vër oorskry en kan 'n verkorte gebruiksduur of selfs swigting van die spoor tot gevolg hê. 'n Reeks metings is namens die Suid-Afrikaanse Spoorweë in die laboratorium en ter plaatse op spoorstawe uitgevoer. 'n Volledige verslag is aan die Suid-Afrikaanse Spoorweë voorgelê.

In order to adapt a reflectoscope for underground measurements it was necessary to develop a new method and auxiliary apparatus. This is described in a paper “On Ultrasonic Reflectoscope with Indicator of the Degree of Coupling between Transducer and Object”, accepted for publication by the Journal of the Acoustical Society of America. In this paper it is shown that the distortion of a radio-frequency pulse—produced by the transducer—is a function of its coupling to the test object. Therefore the distortion can be used to measure the coupling. The trailing edge of the pulse is amplified by a time selective amplifier, rectified and connected to a galvanometer. Different conditions of coupling are analysed. References such as back boundaries are no longer necessary in the field of non-destructive testing.

Underground measurements confirmed that the inspected volume was represented by a cylinder of 10 feet diameter around the test hole drilled into the rock face.

The extent of a fractured zone was determined and it was found that by this method it was possible to distinguish between a fractured, partly fractured and unfractured zone.

The results obtained by the measurements in situ were compared with a core analysis using the same equipment in another version. Both methods agree.

#### **Propagation of Shock Waves in Semi-infinite Media**

The propagation of shock waves through a semi-infinite medium, when a hammer blow is struck on the surface of the medium, is of interest in seismological work in underground rock masses, and short-distance seismic investigations in surface soils.

Experiments carried out on the C.S.I.R. grounds at Brummeria showed that a sharp pulse is indeed lengthened as it is being propagated along the surface of the ground and the results agree well with Ricker's theory. It was found that the elastic constants of the medium could be obtained from the measurements. Further measurements are in progress in order to confirm the initial results.

#### **Vibration of Railway Lines**

The dynamic forces set up in a rail when a train passes over it can be far in excess of the static forces, and can cause a reduced life span, or even failure of the line. A series of measurements were carried out on behalf of the South African Railways on rail sections in the Laboratory and in situ. A full report has been submitted to the South African Railways Administration.



## AKOESTIEK

### Meganiese Opname van Hofverrigtings

Die elektromeganiese opnamesisteme in die Suid-Afrikaanse howe is gedurende die afgelope jaar verder uitgebrei. Hierdie projek het nou die stadium bereik waar geen verdere navorsings- of ontwikkelingswerk nodig is nie.

Twee volledige sisteme is vir die Hooggeregshowe van 'n buurstaat ontwikkel en geïnstalleer.

### Lawaaivermindering in die Nywerheid

Metings is uitgevoer en 4 organisasies is van raad bedien in verband met die demping van lawaai deur lugversorgingsisteme veroorsaak.

## PSIGO-AKOESTIEK

### Vasstelling deur die Gehoorsisteem van die Posisie van 'n Klankbron

Die posisie van 'n klankbron kan deur 'n persoon met normale gehoor baie akkuraat vasgestel word. Daar is reeds vasgestel dat die verskil in die bereiktyd van klankimpulse by die twee ore 'n belangrike rol speel in die vasstelling van die asimultale invalshoek, maar dit is nog nie duidelik hoe 'n mens tussen geluide van voor en van agter kan onderskei nie.

'n Reeks eksperimente is deur een van ons navorsingsbeamptes aan die Universiteit van Göttingen uitgevoer ten einde meer lig op hierdie saak te werp. Die resultate wat verkry is, is vir publikasie weggestuur.

### Kwasi-stereofoniese Klankweergawe deur 'n Enkele Kanaal

Die werk in verband met die sisteem van kwasi-stereofoniese klankweergawe deur 'n enkele kanaal waarop tevore verslag gedoen is, is gedurende die afgelope jaar voortgesit.

'n Vergelyking is gemaak tussen 'n stereofoniese sisteem met twee kanale en die kwasi-stereofoniese sisteem wat in hierdie laboratorium ontwikkel is. Dit het bestaan uit subjektiewe luistertoetse, waarin 'n span van 25 waarnemers twee onbekende sisteme ten opsigte van voorkeur, herkenning en skynbare grootte van die klankbron moes vergelyk. Die waarnemings is uit 3 luisterposisies vir elke waarnemer gedoen.

Uit die toetse het dit geblyk dat die kwaliteit van die kwasi-stereofoniese sisteem naasteby gelyk is aan dié van die konvensionele sisteem, behalwe in die sentrale luisterposisie, waar voorkeur vir die konvensionele sisteem bestaan.

Die direksionele subjektiewe maskeringseienskappe van die gehoormeganisme, wat in stereofoniese waarneming van fundamentele belang is, word tans in die weerklankvrye kamer ondersoek.

## ACOUSTICS

### Mechanical Recording of Law Court Proceedings

The electro-mechanical recording systems in the South African law courts were further extended during the past year. This project has now reached a stage where no further research or development work is required.

Two complete systems were developed for the Supreme Courts in one of the neighbouring territories, and installed.

### Industrial Noise Reduction

Measurements were carried out and four organizations were advised on the damping of noise caused by air-conditioning systems.

## PSYCHO-ACOUSTICS

### Localization of a Sound Source by the Hearing Mechanism

The position of a sound source can be located very accurately by a person with normal hearing. It has been established that the time difference of arrival of the sound pulses at the two ears play an important role in azimuth-localization but it is still not clear how a person can discriminate between sound that comes from in front or from behind.

A series of experiments was carried out by one of our research officers at Göttingen University in order to throw more light on this matter. The results obtained were submitted for publication.

### Single Channel Quasi-Stereophonic Reproduction

Work on the single channel quasi-stereophonic sound reproduction system, continued during the year.

A comparison was made between the two-channel stereophonic system, and the quasi-stereophonic system developed in this laboratory. This consisted of subjective listening tests, using a team of 25 observers, who had to compare two unknown systems on the basis of preference, identification and size of the apparent sound image, with three listening positions for each observer.

From the tests it became clear that the quality of the quasi-stereophonic system approaches that of the conventional system except in the central listening position where there is a preference in favour of the conventional system.

The directional subjective masking characteristics of the hearing mechanism, which is of fundamental importance in stereophonic perception, is at present being determined in the anechoic chamber.



### **Optimum Naklankeienskappe van Kamers vir Spraak**

Kurwes van optimum naklanktye word al baie jare by die ontwerp van vertrekke vir spraak gebruik. Daar bestaan verskeie kurwes van die aard wat almal empiries en op subjektiewe waarnemings gebaseer is.

'n Posing word tans aangewend om die optimum naklankperiodes vir spraak van die onlangs bepaalde integrasie-eienskappe van die gehoorsisteem af te lei.

### **Die Verstaanbaarheid van Klankversterkte Spraak**

Groot vordering is gemaak in die ontwikkeling van klankversterkingstelsels vir spraak, maar tot dusver was weinig bekend van die faktore wat hulle geslaagdheid bepaal wanneer hulle in verskillende soorte vertrekke geïnstalleer word.

'n Ondersoek is ingestel om meer lig op die saak te werp, en daar is bevind dat daar tussen eksperimentele resultate en voorspellings van die verstaanbaarheid op grond van die integrasie-eienskappe van die gehoorsisteem, goeie korrelasie verkry kan word.

'n Artikel getiteld „The Intelligibility of Reinforced Speech” is opgestel en word eersdaags vir publikasie aangebied.

## **ARGITEKTONIESE AKOESTIEK**

Die laboratorium word gereeld in verband met die akoestiese ontwerp en korreksie van kamers, sale en kerkgeboue geraadpleeg. In die afgelope jaar is aan buite-organisasies raad gegee vir die ontwerp van die nuwe Raadsaal in Windhoek, twee Hooggeregshowe te Lusaka, 'n sinagoge in Durban, 'n teater in Port Shepstone en 'n vergadersaal in Springs. Verder is aanbevelings insake die akoestiese verbetering van die Johannesburgse Drilsaal, kerke te Pietermaritzburg en Durban en 'n vergadersaal in Stilfontein gedoen.

## **ELEKTROTEGNOLOGIE**

### **Elektroniese Instrumentasie**

'n Direk lesende spektrometer is ontwikkel met die doel om spektro-chemiese analise te bespoedig en wel deur die fotografiese plaat deur fotoverveelvoudigers te vervang. Laasgenoemde elemente leen hul tot verdere verfyning van die apparaat. Deur gebruik te maak van elektroniese, „hekskakelings” is dit moontlik om die gevoeligheid daarvan te beperk en alleen die verlangde gedeeltes in die ligboogsiklus word te neem. 'n Geskikte metode is ontwikkel en hiermee word die werk in verband met spektrochemiese analises heelwat bevorder.

Die bepaling van lengtestandaard (50 cm.) op grond van golflengtes van lig vereis die telling van 'n baie groot aantal interferensielyne. Om die sleurwerk te verminder

### **Optimum Reverberation Characteristics for Speech Rooms**

Optimum reverberation curves have been used for many years in the design of speech rooms. Various such curves are in existence and all are empirical and based on subjective observations.

An effort is at present being made to deduce the optimum reverberation characteristics for speech rooms from the recently determined integration characteristics of the hearing mechanism.

### **The Intelligibility of Reinforced Speech**

Much progress has been made in the development of speech reinforcement systems but up to the present little was known about the factors governing their success when installed in different types of rooms.

An investigation was carried out in order to throw more light on this matter and it was found that a very good correlation could be obtained between predictions of intelligibility based on the integration characteristics of the hearing mechanism and experimental results.

A paper entitled “The Intelligibility of Reinforced Speech” was prepared and will be submitted for publication.

## **ARCHITECTURAL ACOUSTICS**

The Laboratory is regularly consulted in connection with the acoustical design and correction of rooms, halls and places of worship. During the past year outside organizations were advised on the acoustical design of the new House of Assembly in Windhoek, two Supreme Court rooms in Lusaka, a synagogue in Durban, a theatre in Port Shepstone, and an assembly hall in Springs. Recommendations were also made for the acoustical correction of the Drill Hall in Johannesburg, churches in Pietermaritzburg and Durban, and an assembly hall in Stilfontein.

## **ELECTROTECHNOLOGY**

### **Electronic Instrumentation**

A direct reading quantummeter was developed to speed up spectrochemical analysis by replacing the photographic plate with photo-electric multipliers. The latter, however, lend themselves to further refinements in that by using suitable “gating circuits” their responsiveness may be restricted to the most desirable portion of the spectroscopic arc cycle. A successful method of attaining this was devised. This facility has proved of great value in spectrochemical analysis.

The measurement of a material standard of length (50 cm.) in terms of the wavelength of light involves the counting of a very large number of interference fringes. To minimise the tedium and improve the accuracy, an electronic counter has been designed which distinguishes



en die noukeurigheid daarvan te verhoog is 'n elektroniese teller ontwikkel wat tussen die vooruit- en terugbeweging van lyne kan onderskei. Hy het glo sekere voordele bo vorige ontwerpe. Verdere toetse wag op die verbetering van die optiese sisteem.

Vir gebruik by navorsing in verband met die gesigsenskappe van die menslike oog is 'n ligbron met ligimpulse van konstante tydsduur maar veranderlike frekwensie gebou.

Vir toetse om die vermoeidheid van staalkabels vas te stel, is dit nodig om telkens die breek van 'n enkele vesel te registreer. Dit is gedoen deur die geringe skokgolf wat in die kabel opgewek word wanneer 'n vesel breek deur middel van 'n kristalverklikker waar te neem. Die skok word elektronies versterk en aangewend om die sluit van 'n automatiese kamera af te sit, wat dan die aantal trekspanning-sikluse wat die kabel ondergaan het en wat om 'n meganiese teller geregistreer word, fotografeer. Aangesien die kamerasluiting hom automaties herstel, registreer hy al die trekspanningsikluse waaraan die kabel, van die aanvang van die toets af, onderwerp word.

Op versoek van die Waternavorsingseenheid is 'n selfbalanserende geleidingsbrug gebou wat die geleidingsvermoë van 'n vloeistof op 'n registreermeter weergee. 'n Elektrodehouer geskik vir die voortdurende waarneming van geleidingsvermoë in lopende water is ook ontwikkel.

#### **Automatisasie**

By die toetsing van saadplanters vir landboudoeleindes ontstaan die probleem van die spasiering van saad, soos dit deur die planter geplant word, te bepaal. Aangesien die hande arbeid daaraan verbode onbetaalbaar duur sou wees, is 'n elektroniese hulpmiddel beplan. Die metode waarop besluit is, maak gebruik van afstandmerkers en saadmerkers wat gelyktydig op 'n magnetiese band registreer en elk op 'n afsonderlike draaggolffrekwensie werk. Die inligting kan dan van die magneetband af teruggespeel word en afstand- en saadtellings kan op verskillende maniere in 'n elektroniese apparaat gekorreleer word om aldus die saadverspreiding te analiseer.

'n Prototipe is ontwikkel en word getoets. Hierdie werk word namens die Landbounavorsingsdepartement van die Pretoriase Universiteit onderneem.

#### **Elektroniese Rekenmasjiene**

Die differensieaalontleider „Heiden” is gedurende die afgelope jaar sistematies uitgebrei en bestaan op die oomblik uit 13 summators 9 integrators, 2 funksieontwikkelaars en een vermenigvuldiger. Die ontwerp van die vermenigvuldiger en die noukeurigheid wat met die funksie-ontwikkelaar behaal is, het by ander werkers op hierdie gebied belangstelling gaande gemaak. Die rekenaar is hoofsaaklik vir demonstrasiedoeleindes gebruik en

between forward and backward movement of the fringes and which is believed to have advantages over previous designs. Further tests await improvement of the optical system.

For conducting research on visual characteristics of the eye, a light source capable of supplying light pulses of constant duration but variable frequency was built.

For fatigue testing of steel cables it was desired to record the breaking of single steel strands as they occur. This was achieved by utilizing the slight shock created by the break picked up by a crystal detector, and amplified electronically to open the shutter of an automatically reset camera which photographs the reading on a counter representing the number of cycles of stress applied to the cable since the start of the test.

At the request of the Water Research Unit a self-balancing conductivity bridge was built which will register conductivity on a recording instrument. A suitable electrode holder is also being developed for the continuous sampling of the water in a stream.

#### **Automation**

In testing agricultural seed planters, the problem arises of measuring the spacing between seeds as actually planted. An electronic means of measuring was investigated as the labour costs involved in doing this manually would be prohibitive. The scheme adopted involved recording of space markers and seed markers simultaneously on magnetic tape, using a different carrier frequency for each. The tape could then be played back and the space and seed counts correlated electronically in different ways, in order to analyse seed distribution.

A prototype model was built and is under test. This work is being done on behalf of the Agricultural Research Institute of the University of Pretoria.

#### **Electronic Computers**

The differential analyser Heiden has been systematically expanded during the last year and comprises at present 13 adders, 9 integrators, 2 function generators and 1 multiplier. The novel design of the multiplier has aroused interest amongst other workers in this field as has the accuracy obtained in the function generator. The computer has been used mainly on demonstration problems,



verdere uitbreiding is nodig voordat meer gevorderde probleme aangepak kan word.

'n Navorsingsbeampte van die Afdeling Elektriese Ingenieurswese was 'n lid van 'n tweemanspan wat na 'n ondersoek ter plaatse 'n verslag uitgebring het oor elektroniese syferrekenmasjiene wat op die Engelse mark te kry is. Op grond van hierdie verslag is 'n elektroniese syferrekenmasjien vir die onderafdeling Rekenings van die Afdeling Wiskunde bestel.

## STANDAARDISERING

### Standaardisering van Radioaktiwiteit

Die laboratorium het deelgeneem aan die internasionale onderlinge vergelyking van standaardbronne van radioaktiewe natrium-24, jodium-131 en fosfor-32. Die resultate van hierdie laboratorium het besonder goed ooreengestem met dié van die oorsese lande wat ook deelgeneem het. Nuwe tegnieke wat gebruik maak van vloeistof-installasietellers, is ontwikkel.

### Standaardisering van Stralingsdosisse

Die meganiese konstruksie van die vryelugionisasiekamer is byna voltooi en die ontwikkeling van meettegnieke is reeds aan die gang.

'n Ekstrapolasie-ionisasiekamer vir die meting van dosisse afkomstig van betastraalbronne is gebou en 'n begin met die metings gemaak.

Die X-straaldosismeters van verskeie hospitale is gestandaardiseer.

### Kalibrering van Stralingsapparaat

Ingevolge die vereistes van die Raad op Atoomkrag het hierdie laboratorium die meetapparaat van die ses gemagtigde mediese gebruikers van radioaktiewe isotope, en dié van 'n paar industriële gebruikers gekalibreer.

### Optiese Standaardisasie

Fotometriese standaardisasie van gloeilampe is vir die vervaardigers uitgevoer.

### Elektriese Standaardisasie

#### Nasionale Standaard

Die handhawing van nasionale standaard vir spanning en weerstand is deur die verhuising na die geboue in Brummeria, weens geskikter ruimte en groter betroubaarheid van die temperatuurbeheer, aansienlik vergemaklik.

#### Brug met universele verhouding

Wanneer vergelykings tussen die nasionale standaard van weerstand en 'n eenvoudige veelvoud daarvan gemaak word, kan van welbekende opbou-tegnieke gebruik gemaak word. Dikwels word dit egter nodig om onewe weerstandswaardes met groot noukeurigheid te meet.

and further expansion is necessary to enable it to contend with more intricate practical problems.

A research officer of the Electrical Engineering Division was one of a two-man team which reported on the electronic digital computers available on the British market after an investigation on the spot. On the basis of this report a digital computer has been ordered for the Computation Section of the Mathematics Division.

## STANDARDIZATION

### Standardization of Radio-activity

The Laboratory participated in international inter-comparisons of standard samples of radio-active sodium-24, iodine-131 and phosphorous-32. Good agreement with overseas laboratories was shown. New techniques, using liquid scintillation counters were developed.

### Standardization of Radiation Dosage

The mechanical construction of the primary standard free-air ionization chamber has been almost completed and the development of measuring techniques is proceeding.

An extrapolation ionization chamber for measurement of dose from beta ray sources was constructed and measurements have started.

X-ray dosimeters for various hospitals were standardized.

### Calibration of Radiation Equipment

As required by the Atomic Energy Board, this Laboratory calibrated the radiation monitoring instruments of the six authorized medical users of radioisotopes, as well as those of some industrial users.

### Optical Standardization

Photometric standardizations were carried out for manufacturers of incandescent lamps.

### Electrical Standardization

#### National Standards

The maintenance of the national standards of voltage and resistance has been considerably simplified as a result of more adequate space and of the greater reliability of the temperature control provided in the new laboratory at the C.S.I.R.'s new site.

#### Universal ratio bridge

In making comparisons between the national standard of resistance and simple multiples of an ohm, well-known build-up techniques are available. To cater for odd ratios of resistance which frequently have to be measured with high accuracy, a universal ratio bridge was



Om daarin te voorsien, is 'n brug met universele verhouding ontwerp en gebou. Daarmee kan enige waarde van weerstand in die bereik .0001 ohm tot 100 ohm met 'n noukeurigheid van 1 op  $10^6$  met 'n substandaard vergelyk word. 'n Artikel oor die instrument word vir publikasie opgestel.

#### **Lengtestandaardisasie**

Die ontwikkeling van die interferensiemeter van 50 cm. waarmee lengte gemeet word deur direk die aantal interferensiebande te tel, is nog 'n keer verbeter. Die instrument is in 'n temperatuurstabiliseringshouer in 'n vertrek waar die temperatuur beheer word, ingebou. Eksperimente wat met die fotoversterkertelapparaat uitgevoer is, het getoon dat die gebrek aan kontras in die monochromatiese interferensiebandsisteem, wat deur die instrument „gesien” word, die gevolg van „spookbeelde” was. 'n Metode wat hierdie beelde uitskakel is ontwikkel en word nou getoets.

Die optiese bank vir die vyftigmeter-komparator is voltooi en bestaan uit 'n steenmuur van vyf-en-twintig ton, 167 vt. lank, gemonteer op vier-en-dertig spiraalvere (om vibrasie uit te skakel). Dit blyk of die bank vir die uitvoer van interferensie-eksperimente oor 'n lang afstand uiters geskik gaan wees.

#### **Drukstandaarde**

Gedurende die jaar is substandaardbarometers vir twee weerkundige afdelings van gebiede in Afrika besuide die Sahara, en ook vir die Suid-Afrikaanse Buro vir Standaarde gekalibreer. Daarbenewens is barometers vir 'n elektriese ingenieursfirma gekalibreer.

#### **Akoestiese Standaardisasie**

Verdere werk is gedoen aan die toerusting vir die absolute yking van mikrofone volgens die vrye-veld-resiprositeitsmetode. Substandaardaudiometers wat hierby gebruik word, is bestel.

'n Aantal vibrasieopnemers is volgens 'n resiprositeitsmetode geëyk.

#### **TOETSING VAN TOERUSTING EN MATERIALE**

Die intensiteitsverdeling van straatlampe is vir 'n aantal vervaardigers gemeet; 'n toetsplaat is vir vlakheid nagegaan en vir 'n navorsingslaboratorium is 'n fotometer gekalibreer.

Klankabsorpsiemetings ten opsigte van pas ontwikkelde materiale word gereeld vir buitefirmas gedoen. 'n Groot aantal absorpsiemetings vir sewe verskillende organisasies is uitgevoer.

'n Aantal mikrofone, luidsprekers en bandopnemers is vir buitefirmas getoets en 'n groot aantal elektriese instrumente vir ander afdelings van die W.N.N.R. en vir die nywerheid geëyk.

designed and built. With this bridge any value of resistance in the range .0001 ohm to 100 ohms can be compared with a substandard to a precision of 1 part in  $10^6$ . A publication on this instrument is being prepared.

#### **Length Standardization**

The development of the fifty centimetre interferometer for the measurement of length by the direct counting of interference fringes, was taken a step further. The instrument was enclosed in a temperature stabilizing case within a temperature controlled room. Experiments on the photomultiplier counting system showed that lack of contrast in the monochromatic fringe system which the instrument “sees” was due to “ghost images”. A method of eliminating these images was developed and is being tested.

The optical bench for the 50-metre comparator was set up. This bench, comprising a brick wall, 167 feet long, mounted on 34 springs (to eliminate vibration) and weighing 25 tons, gives every sign of being a satisfactory solution of the problem of carrying out interference experiments over long distances.

#### **Standards of Pressure**

During the year reviewed, substandard barometers were calibrated for two meteorological departments of territories in Africa South of the Sahara, and for the South African Bureau of Standards. In addition, barometers were calibrated for a firm of electrical engineers.

#### **Acoustical Standardization**

Further work was done on the equipment for the absolute calibration of microphones by the free-field reciprocity method. Substandard audiometers to be used with this equipment are on order.

A number of vibration pickups were calibrated using a reciprocity technique.

#### **TESTING OF EQUIPMENT AND TESTS ON MATERIALS**

These tests included measuring the intensity distributions of street lanterns for a number of manufacturers, a gauge plate was tested for flatness and a photometer was calibrated for a research laboratory.

Sound absorption measurements are regularly carried out on newly developed materials for outside concerns. Large numbers of absorption tests were carried out for seven different organizations.

A number of microphones, loudspeakers and tape recorders were tested for outside concerns, and a large number of electrical instruments were calibrated for



Dat daar by nywerheidsondernemings 'n groot vraag na hoogtemperatuurinstrumente bestaan, blyk uit die feit dat meer as 200 termometers, termokoppels en weerstandstermometers geëyk is.

#### **Metings van Hittegeleidingsvermoë**

Die vraag na metings van hierdie aard het toegeneem met die toename in die vervaardiging van isoleringsmateriaal. Meer as 50 sulke toetse is uitgevoer.

Die geleidingsvermoë van grafietskywe is vir die N.Chem.N.L. gemeet.

Ander toetse op materiale soos bepalinge van soortlike warmte, smeltpunt en waterabsorpsie is op versoek uitgevoer.

### **ALGEMENE DIENSTE**

#### **Beskerming teen Bestraling**

Die Filmwapendiens, deur hierdie laboratorium ingestel om werkers, wat ioniserende strale in hospitale en nywerhede gebruik, te beskerm, het in so 'n mate uitgebrei dat 11,539 filmwapens verlede jaar uitgestuur is. 'n Nuwe metode waarby 'n strontium-90-betastraalbron in plaas van 'n x-straalapparaat gebruik word, is ontwikkel om die films te kalibreer.

Stralingsopnames van verskillende x-straaldepartemente is gemaak en in gevalle waar gesondheidsgevaere bestaan het, is die nodige veiligheidsmaatreëls aanbeveel.

#### **Voorkoms van Radon en Radioaktiwiteit in Myne**

'n Navorsingsbeampte van hierdie laboratorium en 'n lid van die Laboratorium van die Kamer van Mynwese het tydens 'n rondreis van drie maande deur die V.S.A. en Kanada 'n studie van allerlei aspekte van die voorkoms van radon en radioaktiwiteit in myne gemaak. Aanbevelings in verband met meettegnieke en die aankoop van die nodige instrumente is gedoen met die oog op verdere werk in die Suid-Afrikaanse myne.

#### **Radio-isotope**

Die Raad op Atoomkrag het op 1 April 1957 die hele invoer en distribusie van radioaktiewe isotope in Suid-Afrika van hierdie laboratorium oorgeneem. Die veertiendaagse onderverdeling van jodium-131 vir mediese doeleindes en die inspeksie van groot bronne word nog deur hierdie laboratorium behartig.

Die Afdeling Biofisika en Toegepaste Radioaktiwiteit tree as Isotoopafdeling van die Raad op Atoomkrag op en heelwat tyd word bestee aan die verskaffing van inligting en hulp aan voorgenome verbruikers van radioaktiewe isotope.

'n Beampte van hierdie laboratorium het gedurende die jaar as „inspekterende fisikus” vir die Raad op

other departments of the C.S.I.R. as well as for industrial firms.

The present wide demand for high-temperature instruments by industrial concerns was illustrated by the fact that over 200 thermometers, thermocouples and resistance thermometers were calibrated.

#### **Thermal Conductivity Measurements**

As the insulation manufacturing industry has developed, the demand for measurements of the conductivity of these products has increased. Over 50 such tests were performed.

Measurements of the thermal conductivity of graphite composition discs were made for the National Chemical Research Laboratory.

Other tests on materials including determinations of specific heat, melting point and moisture absorption were made as requested.

### **GENERAL SERVICES**

#### **Radiation Protection**

The Film Badge Service, run by this Laboratory as a protection service to workers in hospitals and industries using ionizing radiations, is still expanding and 11,539 badges were processed last year. A new method of calibrating these films has been developed, making use of strontium-90 beta ray source instead of an X-ray machine.

Several radiation surveys of X-ray departments were made, and where health hazards were found to exist the necessary protective measures were recommended.

#### **Occurrence of Radon and Radio-activity in Mines**

A research officer from this Laboratory with a member of the Chamber of Mines Laboratory, spent three months touring the U.S.A. and Canada for the purpose of studying various aspects of the occurrence of radon and radio-activity in mines. The necessary instruments and measuring techniques were recommended for further work in South African mines.

#### **Radioisotopes**

On April 1, 1957, the Atomic Energy Board took over the complete importation and distribution of radioisotopes in South Africa from this Laboratory, and only the fortnightly subdivision of iodine-131 for medical purposes as well as the inspection of bigger sources is still carried out by the Laboratory.

The Biophysics and Applied Radio-activity Division is acting as Isotope Division of the Atomic Energy Board and devotes much of its time to supplying information and assisting intending users.

An officer of this Laboratory has this year been acting



Atoomkrag opgetree tydens die afwesigheid van sy beampte wat tans oorsee opgelei word.

#### **Opleiding van Wetenskaplikes in die Gebruik en Hantering van Radioaktiewe Isotope**

14 Wetenskaplikes van verskillende inrigtings buite die W.N.N.R., waarvan twee van naburige state was, het 'n tweeweekse kursus oor isotope, met voltydse voorlesings en praktiese werk, bygewoon. 'n Intensiewe verkorte kursus is vir 14 lede van die W.N.N.R. aangebied.

### **WISKUNDE**

#### **Analitiese Wiskunde**

'n Nuwe projek, wat 'n fundamentele benadering tot die probleem van dinamiese weervoorspelling verteenwoordig, waarby teorieë van die dinamika van die atmosfeer, toegepas word, en gemik is op belangrike praktiese toepassings, is in medewerking met die Suid-Afrikaanse Weerburo begin. Die naoorlogse ontwikkeling van outomatiese rekenmasjiene van hoëfrekwensie het die wêreld se belangstelling in hierdie metode van benadering gestimuleer. Baie verdere navorsing is vir die ontwikkeling van die wetenskaplike metodes in die toestand van die suidelike halfrond nodig.

Fundamentele studies is van abstrakte wiskundige teorieë, wat toepasbaar is op kwantumeganika vibreerstoestande van kristalle, gemaak.

#### **Toegepaste Wiskunde**

'n Elektroniese syfferekenmasjien (hoë frekwensie) van medium grootte, die sogename „Zebra”, is deur die Nasionale Fisiese Navorsingslaboratorium oorsee aangekoop en sal in die komende jaar geïnstalleer word. 'n Begin is gemaak met die opleiding van personeel om die masjien te gebruik.

Studies wat nuwe lig werp op die behandeling van die gedrag van versadigde klei onder druk is in medewerking met die Nasionale Bounavorsingsinstituut gemaak.

#### **Wiskundige Statistiek**

Om na te gaan of twee verskynsels onafhanklik is, is dit dikwels moontlik om die frekwensies van elk in 'n paar klasse te groepeer sodat 'n bepaalde frekwensie vir elke kombinasie bestaan. In die klassieke teorie van statistiese toetsing word gebruik gemaak van die feit dat die totale grootte van die steekproef vooraf bepaal is. Tans is 'n teorie afgelei wat statistiese toetse gee wanneer slegs die frekwensie vir een kombinasie bekend is. Hierdie toetse sal by die studie van seldsame kombinasies soos dié wat dikwels in biologiese waarnemings voorkom, van waarde wees.

as inspecting physicist for the Atomic Energy Board in the absence of its officer training overseas.

#### **Training of Scientists in the Use of Radio-activity**

An isotope course of two weeks duration, consisting of full time lectures and practical work, was attended by 14 scientists from various institutions outside the C.S.I.R. of which two were from a neighbouring state. A considerably abbreviated course was given to 14 members of the C.S.I.R.

### **MATHEMATICS**

#### **Analytical Mathematics**

A new project representing a fundamental approach to the problem of dynamic weather forecasting, using theories of the dynamics of the atmosphere and aiming at important practical applications, was initiated in collaboration with the South African Weather Bureau. The post-war advent of high speed automatic computing machinery has given great impetus to world interest in this kind of approach and a great deal of research is needed for developing scientific methods under conditions in the southern hemisphere.

Fundamental studies have been made in abstract mathematical theories which are applicable to quantum mechanics and states of vibration of crystals.

#### **Applied Mathematics**

An electronic (high-speed) digital computing machine of medium size, called "Zebra", was purchased abroad by the National Physical Research Laboratory, and is due for installation in the coming year. A start has been made with the training of personnel to use this machine.

Studies shedding new light on the treatment of the behaviour of saturated clays under load were pursued in collaboration with the National Building Research Institute.

#### **Mathematical Statistics**

When considering whether two phenomena are independent it is often possible to group the frequencies into a few categories in which a definite frequency will correspond to each combination. In the classical theory of statistical testing, use is made of the fact that the total size of the sample is previously fixed. A theory has now been derived giving statistical tests when the frequency for only one combination is fixed. These tests will be valuable in the study of such rare combinations as are often found in biological observations.



Navorsing in verband met transformasies om statistiese verdelings te normaliseer en terselfdertyd die variansie te standaardiseer, word voortgesit. Die resultate van navorsing in verband met die eienskappe van diskrete waarskynlikheidsfunksies van binomiaal- en negatiewe binomiaaltipes is in 'n doktorale proefskrif opgeneem. Daar is bevind dat hierdie teoretiese verdelings op sulke uiteenlopende gebiede soos medisyne, weerkunde en nywerheidsongelukke 'n toepassing vind. Modelstudies is gemaak van tydreekse wat deur autoregressievergelykings met binomiale verstoringsterme ontwikkel word.

### **Toegepaste Statistiek**

Verskeie institute van die Wetenskaplike en Nywerheidsnavorsingsraad besef al hoe meer hoe voordelig dit is om 'n statistikus as lid van 'n navorsingsspan te hê. Van die belangrikste projekte waaraan die sentrale statistiekafdeling deelgeneem het, kan die volgende as voorbeeld dien; 'n statistiese studie om die spitsure van ongelukke in stedelike gebiede te bepaal; 'n analise van rotsstortings in myne waarin klein dyke en gange voorkom; regressiestudies om die invloed van verskillende faktore in bouwerke te bepaal.

### **Biometrie**

Namens die Pneumokoniose-Navorsingseenheid is 10,000 verslae wat die Mediese Pneumokoniose buro en Pneumokonioseraad hou, ondersoek en die nodige data daaruit verkry. Dit is verslae van mynwerkers van wie daar in die periodes 1925 tot 1935 en 1946 tot 1956 vir die eerste keer vasgestel is dat hulle aan pneumokoniose lei. Hierdie breedvoerige statistiese ondersoek van die voorkoms van pneumokoniose word uitgevoer teneinde die veranderlikes vas te stel soos byvoorbeeld ouderdom, jare van ondergrondse diens, ambag en onderbroke teenoor ononderbroke diens, wat die voorkoms van pneumokoniose moontlike kan beïnvloed.

Ander biometriese probleme soos die statistiese beplanning en analise van 'n aantal voedingseksperimente onder mense, en die bepaling van 'n koëffisiënt vir die bederf van entstof, is behandel.

### **Algemene Dienste**

As voorbeelde van die talle dienste van wiskundige of statistiese aard, aan laboratoria van die Wetenskaplike en Nywerheidsnavorsingsraad en aan buitestaande organisasies gelewer, dien die analitiese en numeriese berekening van talryke integrale, die oplossing van differensiaal- en integraalvergelykings, die verskaffing van bewys van bestaan of nie-bestaan, die berekening van standaardfoute en korrelasiekoëffisiënte.

Research into transformations to normalize statistical distributions and at the same time to standardize the variance is in progress. The results of research into the properties of discrete probability functions of binomial and negative binomial types were included in a doctoral thesis. These theoretical distributions were found to have applications in such divergent fields as medicine, meteorology and industrial accidents. Model studies were made of time series which are generated by autoregression equations with binomial disturbance terms.

### **Applied Statistics**

The advantage of having a statistician as member of a research team is increasingly appreciated by the various institutes of the Council for Scientific and Industrial Research. Of the major projects in which the central statistical section participated, the following examples may be given: a statistical study to show the accident peak hours for urban areas; an analysis of rock bursts in mines associated with small dykes and raises; regression analyses to determine the influence of various factors in building operations.

### **Biometrics**

On behalf of the Pneumoconiosis Research Unit some 10,000 records kept by the Pneumoconiosis Medical Bureau and Pneumoconiosis Board were examined and the necessary data extracted. These were records of miners who were found to be suffering from pneumoconiosis for the first time during the periods 1925 to 1935 and 1946 to 1956. This detailed statistical investigation into the incidence of pneumoconiosis is an attempt to segregate the variables such as age, years of underground service, occupation, and broken versus continuous service, which could exert an influence on the incidence of pneumoconiosis.

Other biometrical problems such as the statistical planning and analysis of a number of nutrition experiments on human beings and the determination of a coefficient for the decay of vaccine were dealt with.

### **General Services**

As example of the many services of a mathematical or statistical nature rendered to laboratories of the Council for Scientific and Industrial Research and to outside bodies, the analytical calculation and numerical computation of numerous integrals, the solution of differential and integral equations, the supplying of proofs of existence or non-existence, the calculation of standard error and correlation coefficients may be quoted.



# Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese

*Direkteur:* DR. W. L. GRANT

Die doelstelling van die Nasionale Navorsingsinstituut vir Meganiese Ingenieurswese is, eerstens, om probleme waarmee die nywerheid in Suid-Afrika te kampe het, te ondersoek, en tweedens, om fundamentele ondersoek in te stel op gebiede wat in die toekoms van besondere belang vir die land kan wees. Alhoewel die werk van die Instituut hoofsaaklik 'n voortsetting van verskeie langtermynprojekte is, was daar 'n aansienlike aantal nuwe ondersoeke wat ook in die onderhawige tydperk aangepak is.

Namate die waarde van navorsing vir die nywerheid bekend geword het, het die werk dan ook so toegeneem dat sommige van die onderafdelings byna voltydse besig was met werk vir verskillende nywerhede. Die Onderafdelings wat veral daarby betrokke was, is Sterkteleer, Meganika, Hittevoortplanting en Lugversorging en Verkoeling. Daar het ook weer talle probleme voorgekom in verband met swigtings tydens werking, wat meesal deur die onderafdeling metallurgie behartig is.

Die gieterijbedryf het 'n beurs gestig om die ondersoek van probleme in verband met geskikte gieterysand vir dié nywerheid te steun. Dit gee 'n verdere aanduiding van die aard van die diens wat die laboratorium aan die nywerheid kan lewer. Ter aanduiding van die omvang van die werk wat ten behoeve van die nywerheid gedoen word, dien die feit dat daar gedurende die afgelope jaar werk ter waarde van byna £37,000 deur die Instituut onderneem is. Benewens hierdie werk is ook 'n groot aantal navrae afgehandel waarin advies verleen is oor wyd uiteenlopende vraagstukke in verband met die meganiese ingenieurswese.

Hoewel dienste aan die nywerheid 'n baie belangrike funksie van die Instituut is, moes daar nogtans voorsiening gemaak word vir geriewe vir navorsing op gebiede van besondere nasionale belang. Daar is dus in die afgelope jaar ook aandag geskenk aan toetsgeriewe vir die Afdeling Hidrodinamika, wat steeds meer navrae van die nywerheid begin ontvang. 'n Verdere uitbreiding wat in die vooruit sig gestel word, is dié op die gebiede van hoëspoedlugdinamika en gasdinamika waarvoor navorsingsgeriewe beplan word.

## METAALKUNDE

In die afgelope jaar is die mikrografiese fasiliteite van die Metallurgiese Laboratorium uitgebrei om die gebruik van deurgelate lig moontlik te maak. Die nuwe toe-

# National Mechanical Engineering Research Institute

*Director:* DR. W. L. GRANT

The activities of the National Mechanical Engineering Research Institute fulfil two main purposes—firstly, the investigation of problems which occur in industry in South Africa and, secondly, fundamental research into problems in the fields of mechanical engineering which might be of special importance to the country in the future. Although the major part of the work of the Institute was concentrated upon the continuation of work on several long-term projects a considerable number of new investigations were undertaken during the period reviewed.

Growing appreciation by [industry of the returns which can be reaped from research, increased the work of the Institute to such an extent that some subdivisions were occupied almost full time on work for various industrial sponsors. Those most concerned were the Strength of Materials, Mechanics, Heat Transfer and Air-Conditioning and Refrigeration Sections. In addition, numerous problems involving the failure of materials in service were successfully investigated by the Metallurgy Section.

A Foundry Sands Research Fellowship, financed by the foundry industry was established to enable the problems connected with the suitability of sands for foundry work to be investigated. Furthermore, the fact, that during the year under review Industry paid nearly £37,000 for research to be conducted in the Institute, indicates the volume of work being undertaken. In addition, numerous enquiries, covering a broad field in mechanical engineering, were attended to and advice was given where requested.

Although these services to industry constituted a very important function of the Institute, provision was also made for facilities for research into subjects of special national importance. Further attention was paid to the testing facilities of the Hydromechanics Division which has been receiving enquiries from Industry to an increasing extent. Further expansion is envisaged in the fields of high speed aero-dynamics and gas dynamics for which research facilities are being planned.

## METALLURGY

The micrographic facilities of the Metallurgical Laboratory were expanded to make possible the use of transmitted light. The new equipment was successfully



rusting is reeds met welslae gebruik vir petrologiese ondersoek verbode aan die rotsstortingsprojek, en sal noodsaaklik wees vir die voorgestelde navorsing in verband met Suid-Afrikaanse gietersande.

Soos in vorige jare, is 'n aansienlike gedeelte van die werksaamhede van die laboratorium op ondersoek ten dienste van die nywerheid toegespit.

#### **Voorvervorming en die Plastiese Eienskappe van Metale**

Die uitwerking van voorvervorming op die plastiese eienskappe van metale en legerings is regstreeks van praktiese belang, aangesien dié eienskappe in groot mate die verskillende metaalvervormingsprosesse beïnvloed. Ondersoek van die invloed van voorvervorming op die plastiese eienskappe van metaalenkristalle, wat die eenvoudigste metaalstruktuur verteenwoordig, is derhalwe voortgesit.

Met die geslaagde ontwikkeling van metodes vir die kweek van enkelkristalle van sink van hoë suiwerheid, en vir „vervormings-vrye” masjinerie, is heelwat werk bestee aan die ontwikkeling van 'n toetsapparaat, waarin die enkelkristalle aan skuifbelasting onderwerp word. 'n Dooiegegewig-skuifbelastingstoel is vervaardig en 'n optiese stelsel vir vervormingsmeting gebou.

Aangesien hoë gevoeligheid en betroubaarheid voorvereistes is vir die vervormingsmetings, word die betrokke verlengingsmeter tans sistematies getoets om die akkuraatheid daarvan te bepaal.

Voorlopige resultate dui aan dat die verloop van die belastingsiklus 'n invloed uitoefen op die eienskappe van die enkelkristalle, en dat variasie in kamertemperatuur moontlik 'n sekondêre invloed uitoefen.

Die werk wat op die oomblik gedoen word, is gerig op die noukeurige bepaling van die wisselwerking van hierdie invloed en in watter mate hulle die eienskappe van enkelkristalle bepaal.

#### **Invloed van Spanning op Korrosie**

Die gelyktydige inwerking van spanning en korrosie kan, in sekere gevalle, vinnige verswakking en selfs swigting van metale en legerings veroorsaak. Hierdie verskynsel, wat bekend staan as spanningskorrosie, is dus van sowel akademiese as praktiese belang.

Die praktiese konsekwensies van spanningskorrosie is veral beklemtoon deur die onlangse swigting tydens gebruik van 'n aantal aluminium-geelkoperkondensorbuis. 'n Ondersoek na die swigtingsoorsaak is ten behoeve van 'n nyweraar uitgevoer, en het bewys gelewer dat die swigtings ontstaan het deur 'n spanningskorrosiemeganisme.

Die grondbeginsels van kraking weens spanningskorrosie word tans ondersoek. Eerstens word die invloed van interkristallyne oriëntasie op gevoeligheid vir spanningskorrosie sowel by alfa- as beta-geelkoper bepaal. Die kweek van enkel- en bi-kristalle is vir die ondersoek nodig en geskikte oonde en kristalvorms is gebou.

used in petrological investigations associated with the rockburst research at present being carried out, and will be an essential item in the activities of the recently established Foundry Sands Research Fellowship.

As in previous years, much of the Laboratory's effort was concentrated upon investigations on behalf of industry.

#### **Predeformation and Plastic Properties of Metals**

The influence of predeformation upon the plastic properties of metals and alloys has a very definite practical bearing upon the various methods of forming and shaping metals, because such processes depend largely upon the plastic properties of the material. An investigation into the influence of predeformation on the plastic properties of metal single crystals, which represent the simplest form of metal structure, was therefore continued.

After successfully developing methods of producing single crystals of high purity and of machining them "strain-free", much effort was devoted to the design and development of equipment for testing crystals under shear loads. A dead-weight shear loading device and an optical extensometer for measuring the shear deformation of the crystals were manufactured. Since the reliability of the investigation depends largely upon the accuracy with which the deformations are measured, the extensometer is being very systematically tested to ensure its reliability.

Some results so far obtained have indicated that the loading cycle history of the single crystals influences their properties and that variations in ambient temperature may also exercise a secondary effect.

Work at present being conducted aims at determining, precisely, what factors of influence exist, and to what extent they have a bearing on the properties of single crystals.

#### **Influence of Stress on Corrosion**

The simultaneous action of stress and corrosion may, in certain cases, produce rapid deterioration and even failure of metals and alloys. This phenomenon, which is known as stress-corrosion, is not only of academic interest but of great practical importance.

The practical implications of stress-corrosion were emphasized in recent failures of a large number of aluminium-brass condenser tubes. The investigation into the cause of the failure, conducted on behalf of a large industrial firm, showed that the failures had been initiated by a stress-corrosion mechanism.

The fundamentals of stress-corrosion cracking are, therefore, being investigated. In the first instance, the effect of intergranular orientation on susceptibility to stress-corrosion is being evaluated in both alpha- and beta-brass. This work requires the production of both single crystals and bi-crystals; suitable furnaces and crystal moulds were constructed for this purpose.



### Alkaliëse Verbrossing van Keteldromstaal

Alkaliëse verbrossing van geklinkte stoomketeldromme is nog steeds 'n groot probleem in die nywerheid. Alhoewel baie aandag alreeds aan die probleem bestee is, is tot dusver geen aanneemlike verklaring vir die grondoorzaak en meganisme van hierdie verksynsel gevind nie.

Die belangrikheid daarvan is beklemtoon toe 'n groot aantal krake in lokomotiefstoomketels onlangs vir 'n nywerheidsonderneming ondersoek is. 'n Omvattende metallurgiese en meganiese ondersoek het duidelik bewys dat die krake ontstaan het deur 'n alkaliëse verbrossingsmeganisme.

Ondersoek na die verskynsel word voortgesit. Aangesien die monsters onder belasting in seepsodaoplossings by hoë temperatuur en drukke getoets moet word, is geskikte belastingstoestelle ontwerp en vervaardig en die toetse in 'n outoklaaf uitgevoer.

### Vervormingsprosesse in Geelkoper

Die vervormingsprosesse wat geelkoper-legerings ondergaan, is van sowel praktiese as akademiese belang, al is dit net omdat die inherente brosheid van beta-geelkoper nog nie verklaar kan word nie.

Gegewens oor die tipe, aard en distribusie van vervorming in koud-verwekte alfa- en beta-geelkoper is ingewin deur middel van die sogenaamde etsfiguurtegniek, wat ontstaan het as gevolg van die ontwikkeling van 'n nuwe etsmiddel. Sekere chemiese etsmiddels het selektiewe invretingseienskappe ten opsigte van die manier waarop hulle gepoleerde metaaloppervlaktes aantast, met die gevolg dat etsgaatjies van bepaalde geometriese vorm ontstaan. Die vorm, aantal en distribusie van hierdie etsgaatjies verskaf nuttige inligtings aangaande die kristalorientasie van die metaalkorrels en die aard en intensiteit van plaaslike vervorming.

Daar is bewys dat vervorming plaasvind namate gliplyne en vervormingsbande ontwikkel maar dat laasgenoemde hoofsaaklik 'n oppervlakproses is in beta-geelkoper. Huidige werk het as doel die verkryging van 'n beter begrip van die invloed van korrel- en sub-grense op die vervorming en voortplanting van vervormingsbande, en 'n studie van die herstellingsproses in vervormde monsters met uitgloei by verskillende temperature.

### Swigtings tydens Gebruik

Baie gevalle van swigtings tydens gebruik is vir die nywerheid ondersoek. 'n Paar van die interessantste gevalle was die splyting van drade in myntoue, gebreke in lokomotiefketelplate, en die swigting van die aandryf-ratte van 'n groot suikerfabriek, 'n roesvrye staaltenk, palette van aluminium-legering en termokoppels van edelmetaal.

In al hierdie gevalle is die oorsake van swigting vasgestel en aan die opdraggewer raad gegee in verband met voorsorgmaatreëls om toekomstige swigtings te verhoed.

### Caustic Embrittlement of Boiler-Plate Steel

The caustic embrittlement of riveted steam boiler drums continues to present a serious industrial problem. Although much attention has already been devoted to this problem, no satisfactory explanation with respect to the basic causes and mechanism of the phenomenon can yet be offered. Its importance was emphasized when an epidemic of fractures in locomotive boilers was investigated on behalf of an industrial concern. A comprehensive metallurgical and mechanical investigation clearly revealed that the fractures were created by a caustic cracking mechanism and research into this phenomenon is being continued.

Since the test specimens have to be stressed and exposed in caustic soda solutions at high temperatures and pressures, suitable loading jigs were designed and manufactured and the tests conducted in a suitable autoclave.

### Deformation Processes in Brass

The deformation processes which occur in brasses are not only of academic but also of practical interest, even if only for one reason, namely, that the inherent brittleness of beta-brass is as yet not clearly understood.

Information concerning the type, nature and distribution of deformation in cold-worked alpha- and beta-brass was obtained by the use of the so-called etch-figure technique, which resulted from the development of a new etching reagent. Certain chemical etchants are very selective in the manner in which they attack the polished surfaces of metals, and this results in the development of etch-pits of definite geometrical shapes. The shape, number and distribution of these etch-pits provide useful data concerning the orientation of the metal grains and the nature and intensity of localised deformation.

It was found that deformation occurred by the successive formation of slip-lines and deformation-bands. In contrast to alpha-brass the occurrence of slip-lines in beta-brass was essentially confined to the surfaces of the specimens while deformation-bands also occurred at considerable depth. Work at present being conducted aims at obtaining a clearer understanding of the effects of grain and sub-boundaries upon the formation and growth of deformation-bands, and at studying the mechanism of the recovery phenomena in deformed specimens when they are annealed at different temperatures.

### Failure in Service

Many failures in service were investigated on behalf of industry. The splitting of the strands in wire haulage ropes, defects in locomotive boiler plates, the failure of large sugar mill gear wheels, of a stainless steel tank, of aluminium alloy pallets and of noble metal thermocouples were typical of the more interesting types of failure investigated. In every case the cause of failure was established and the sponsor advised of ways and means of preventing further trouble.



**Vermoeidheid van Metale**

Werk in verband met die vermoedheid van metale is voortgesit. Ondersoeke in verband met die invloed van spanningsiklusfrequentie op silindriese proefstukke, onderworpe aan wentelbuiging, het voorrang geniet. Bykomende faktore soos die temperatuurstyging van monsters gedurende die vermoedheidstoetse en die uit-skakeling van atmosferiese korrosie, het besondere aandag geniet. Dit het geblyk dat die gebruiksdur van besondere staalsoorte voor swigting weens vermoedheid, volgens toetsing in 'n oplossing van kaliumchromaat langer is as die gebruiksdur volgens toetsing in atmosferiese toestande. Word alle ander invloedsfaktore egter in ag geneem, bly daar nog aansienlik invloed oor van die spanningsiklusfrequentie wat moontlik aan die veroudering van die staal toegeskryf kan word. Verdere toetse in verband met nie-verouderende staalsoorte word beplan.

**Vermoeidheid in Spoorstawe**

Die ondersoek in verband met vermoedheid in spoorstawe vir die Suid-Afrikaanse Spoorweë is voortgesit.

Gedurende die tydperk onder bespreking is die ondersoek van die werkverrigting van gesweiste spoorstawe in vermoedheidsbelastingstoestande voltooi. Op grond van die bevindings kon die gebruiksdur, voor swigting weens vermoedheid, van termiet- en booggesweiste spoorstawe met dié van gewalste spoorstawe vergelyk word. Die invloed van lasplaatgate op die gebruiksdur van gesweiste spoorstawe is ook ondersoek en die bevinding was dat die spanningskonsentrasie naby lasplaatgate so groot is dat die invloed van die aanwesige gate op die gebruiksdur dié van die sweisnaat kan oorskadu. 'n Verdere reeks toetse is uitgevoer om die gebruiksdur van spoorstawe wat reeds 'n tydperk in gebruik is, te ondersoek. Daar is bevind dat die getoetste spoorstawe nog met veiligheid onder sekere omstandighede gebruik kan word.

'n Deel van hierdie werk is onder die titel „The fatigue strength of thermit welded rails” deur R. S. Loubser, op die „British Commonwealth Welding Congress 1957” voorgedra.

Nog 'n ondersoek wat voortgesit word, handel oor die vermoedheid van spoorstawe wat op 'n draai ingebruik is. Die spannings wat in die praktyk optree wanneer 'n lokomotief of 'n trek om 'n draai loop, word in die laboratorium gesimuleer deur kort stukke spoorstaaf te onderwerp aan wisselende dwarsbuigbelastinge wat op 'n dwarsvoorbelasting gesuperponeer word. Die geleidelike aangroei van barsies wat in hierdie toestande by sekere spannings voorkom, is waargeneem. Krommes van die spannings by swigting, gemeet deur middel van rekstrookies in die gebied waar die barsies voorkom, is vir die verskillende lengtes van barsies uitgesit, sodat die

**Fatigue in Metals**

Investigations into various aspects of the phenomenon of fatigue in metals were continued. Tests to determine the influence of the frequency of the stress cycle upon the fatigue limit of cylindrical test specimens subjected to rotating bending were given high priority. Special attention was paid to such factors as the temperature of the specimens and the protection from atmospheric corrosion which might have an influence upon the results. The fatigue life of the particular steel investigated at low stress cycle frequencies, was found to be longer when tested in a solution of potassium chromate, than when tested under atmospheric conditions. If all other possible factors of influence are taken into account, however, there still remains a considerable stress cycle frequency effect which may possibly be ascribed to ageing phenomena. Further tests on non-ageing steels are being planned.

**Fatigue in Rails**

Research into the fatigue of rail specimens was continued on behalf of the South African Railway Administration.

During the period under review research into the behaviour of welded rails under cyclic stress conditions was completed. From the results obtained it was possible to compare the fatigue life of unwelded rails with those having thermit-welded or arc-welded joints. The influence of fish-plate holes on the fatigue life of welded rails was also investigated. It was found that the stress concentration near the fish plate holes is so great that its effect upon the fatigue life of the rail largely overshadows the effect of the welded joint in the rail. A further series of tests was conducted to investigate the fatigue life of rails which had been in use for some time. It was found that the rails tested could continue to be safely used under certain conditions.

Part of the work described above was published in a paper by R.S. Loubser: “The Fatigue Strength of Thermit Welded Rails” read at the British Commonwealth Welding Congress—1957.

The investigations into the fatigue of rails used in curves in the track were continued. The stresses which occur when a locomotive or a truck negotiates a curve, were simulated in the laboratory by subjecting short lengths of rail to alternating lateral bending loads superimposed upon a lateral pre-load. It was observed that, under these loading conditions, cracks gradually develop at certain stress levels. The stresses were measured by means of wire resistance strain gauges cemented in the areas in which the cracks occur. The number of stress cycles at which cracks first occur or assume a certain length, was graphically plotted against the stress. In



spannings wat in die praktyk die krake in die spoorstawe veroorsaak het, bepaal kan word. Hierdie ondersoek is uitgevoer met gewone koolstofstaalspoorstawe en spoorstawe van staal met 'n hoë mangaangehalte, wat 'n groter slytasieweerstand as die gewone spoorstawe het. Die doel van die ondersoek is om vas te stel of die vermoeidheidweerstand van die stawe met hoë mangaangehalte bevredigende eienskappe besit.

#### **Vermoeidheid in Draadtoue en Staaldraad van hoë Treksterkte**

Hierdie ondersoek is daarop gemik om te bepaal wat die invloed van die verskeie veranderlikes in draadtoukonstruksie op die gebruiksduur van draadtoue is. Gegewens van hierdie aard sal die vervaardigers van draadtou in staat stel om die betroubaarheid en diensbaarheid van hul produkte te verbeter. Voordat roetine-toetse op die vermoeidheidstoetsmasjien van 100 ton 'n aanvang kon neem, moes 'n geskikte metode ontwikkel word om die toumonsters in die masjien vas te klem. 'n Vereiste was die ontwikkeling van 'n betroubare toestel om die swigting van individuele drade tydens 'n vermoeidheidstoets op 'n basis van totale aantal siklusse voor swigting vas te stel. Hierdie probleme is albei bevredigend opgelos ten opsigte van hysbaktoue van  $\frac{1}{2}$  duim deursnee en mynhyserstoue van  $1\frac{1}{2}$  duim deursnee.

Voorlopige toetse, tans in volle gang, behoort voldoende gegewens oor die invloed van monsterlengte en toetsfrekwensie op die vermoeidheidsgrens te verstrek om die toetsmetodes vir die bepaling van hierdie twee veranderlikes vir die verdere toetsprogram te standaardiseer.

#### **Die Spanning in Mynhyserdromme en die Druk daarop**

Aangesien die bestaande metodes vir die ontwerp van mynhyserdromme in die geval van groot swaarbelaste dromme onbevredigende resultate lewer, het dit noodsaaklik geword om 'n betroubaarder ontwerpsformule op te stel. 'n Reeks toetse is derhalwe uitgevoer met 'n silindriese mynhyserdrom van 16 voet deursnee wat werklik in gebruik is met 'n belasting van  $3\frac{1}{2}$  lae  $1\frac{3}{4}$ -duims tou. Die spannings in die dromwand is met behulp van rekstrookies op verskeie punte bepaal. 'n Druksel is in die laboratorium ontwikkel en gebruik om die druk tussen die eerste laag tou en die dromwand te meet namate die verskillende toulae daarop gedraai is. Sodoende is voldoende gegewens ingewin om die betroubaarheid van die verskeie bestaande ontwerpsmetodes te toets, wat as grondslag kan dien vir die ontwikkeling van nuwe ontwerpsmetodes. 'n Interessante afleiding was dat die totale druk op die dromloopvlak met drie en 'n half lae tou daarom gedraai, slegs effens minder was as die som van die teoretiese belastings deur elke afsonderlike laag uitgeoefen.

this manner the stresses associated with cracks of various lengths observed in rails used in practice can be determined. Carbon and manganese steel rails were used in the tests, the latter being used in practice because they possess a higher wear resistance than the former. The object of this investigation is to determine whether manganese rail steel has satisfactory fatigue properties.

#### **Fatigue in Wire Ropes and High Tensile Steel Wires**

This investigation aims at determining the effects of the different variables in rope construction on the fatigue life of wire ropes. Information of this nature will enable manufacturers of wire ropes to increase the reliability and service life of their products. Before routine testing in the Institute's 100-ton tensile fatigue machine could be started, it was necessary to devise a means of gripping the wire rope specimens in the machine. It was also necessary to develop a reliable instrument for detecting failure of individual wires and for recording the total number of stress cycles at which individual wires failed. Both these problems were solved satisfactorily for  $\frac{1}{2}$ -inch diameter elevator ropes and for  $1\frac{1}{2}$ -inch diameter winding ropes.

The tests, which are now in progress, should yield sufficient information on the effects of specimen length and cyclic frequency on the fatigue properties of  $1\frac{1}{2}$ -inch diameter winding ropes to enable the standardization of the test procedure with respect to these two factors for future investigations.

#### **Stress in, and Tread Pressures on Mine Winder Drums**

The basis upon which mine winder drums were designed in the past, has proved unsatisfactory for the larger and more heavily loaded drums used today. It, therefore, became imperative that a more reliable design basis should be developed. In order to determine the stresses in and tread pressures on winder drums a series of tests was conducted on an actual mine winder drum 16 feet in diameter, and loaded with  $3\frac{1}{2}$  layers of steel wire rope  $1\frac{3}{4}$ -inch in diameter. Stresses at various points in the drum shell were measured by means of wire resistance strain gauges cemented onto the inside of the shell. A special hydraulic load cell was developed in the laboratory and was used to determine the pressure between the first layer of rope and the drum shell as the various layers were wound on the drum. This information will be used to check the reliability of the existing design formulae and may form the basis for the development of new design methods. The fact that the total pressure on the drum shell on which  $3\frac{1}{2}$  layers of rope were wound, was only slightly less than the sum of the theoretical pressures due to each separate layer, was an interesting observation which emerged from the investigation.



### **Verdere Ondersoeke ten Behoeve van die Nywerheid**

Etlike kleiner ondersoeke ten behoeve van die nywerheid is onderneem, onder andere 'n ondersoek na die vermoedingsweerstand van boorstawe. Die bevinding was dat die gebruiksduur van boorstawe sterk deur die toestand van die oppervlakte beïnvloed word. Hierdie ondersoek sal nog verder uitgebrei word.

Verskillende toetse, soos bv. gewone trektoetse, gekombineerde trek- en buigtoetse, slagtoetse ens., is uitgevoer in verband met verskillende boue van hoë treksterkte, om die kwaliteit, en veral die sterkte en vormingsvermoë van hierdie boue te bepaal.

Toetse is ook uitgevoer om die spannings in dakboue in myne deur middel van rekstrookies te meet.

### **Benutting van Plaaslike Hout vir Verpakkingsdoeleindes**

Tot dusver was hierdie ondersoek beperk tot die geskiktheid van plaaslik gekweekte hout vir die vervaardiging van sitruskissies.

'n Opname is gemaak van die neigings in sitrusverpakking in Suid-Afrika en elders en van die eksperimentele werk wat voor 1956 deur die Suid-Afrikaanse Buro vir Standaard en die Suid-Afrikaans Sitrusbeurs, Beperk, uitgevoer is. Die opname het aangetoon watter aspekte nog ondersoek moet word om die betrokke nywerhede te oortuig dat Suid-Afrikaanse hout net so geskik vir sitruskissies is as ingevoerde hout. 'n Program is opgestel vir toetse om verskillende metodes van bedekseling van kissies te vergelyk en die uitwerking van kwaste op die sterkte van kiplankies te ondersoek. Die werk vorder goed.

'n Ondersoek is ook ingestel om die volume hout wat in Suid-Afrika beskikbaar en geskik is vir die vervaardiging van sitruskissies te bepaal.

## **MEGANIKA**

### **Dempingsvermoë van Materiale**

Die dempingsvermoë van 'n materiaal is die eienskap wat hy besit om trillings wat in die materiaal voorkom, te demp. Kennis van die dempingsvermoë van 'n materiaal is van belang nie alleen in verband met trillingsprobleme nie, maar ook in verband met die vermoedingsweerstand van die materiaal. Navorsing reeds gedoen in verband met die dempingsvermoë van materiale, is voortgesit en veral toegespits op die fundamentele probleme van trilling en vermoedingsweerstand soos dit heel dikwels in ingenieurswerk voorkom.

Die resultate van vorige werk het bewys dat noukeuriger instrumente as dié wat in die verlede in gebruik was vir betroubare resultate nodig sou wees. As gevolg van die ombouing van die meetapparaat, is dit nou moontlik om resultate te verkry wat na willekeur herhaal kan word.

### **Other Investigations Conducted for Industry**

A number of minor investigations were conducted on behalf of industry, one being an investigation into the fatigue strength of drill rods. It was found that the fatigue life of drill rods was largely affected by the surface condition of the rod. This investigation will be extended.

A series of tests, including tensile tests, combined tensile and bending tests and impact tests was carried out on various high tensile steel bolts to determine their quality, especially their strength and ductility.

Other tests were carried out to determine, by means of wire resistance strain gauges, the stresses which occur in roof bolts used in mines.

### **Utilization of Local Timber for Packaging Purposes**

So far, work on this project has been limited to determining the suitability of locally grown timbers for use in citrus boxes.

A survey was made of the trends in citrus packing in South Africa and elsewhere, including an account of the experimental work performed before 1956, by the South African Bureau of Standards and the South African Co-operative Citrus Exchange, Ltd. This survey gave indications as to what aspects should be investigated to prove to the local citrus industry that South African timber is as suitable for use in citrus boxes as imported timber. A programme was drawn up, the proposed tests aiming at comparing the various methods of securing a lid to a box and also at determining the effect of knots upon the strength of shooks. Work on this project is making satisfactory progress.

An investigation was also conducted to determine the total quantity of timber available in South Africa suitable for making citrus boxes.

## **MECHANICS**

### **Damping Capacity of Materials**

Damping capacity is the ability of a material to decrease the amplitude of vibrations by means of irreversible internal processes. The knowledge of this property is of importance not only in vibration problems, but also because it has a bearing on the subject of the fatigue life of the material. Research into the damping capacity of materials was therefore continued as being of fundamental importance to vibration and to fatigue problems which often occur in engineering practice.

Results of previous work indicated that more precise instrumentation was required if reliable results were to be obtained. By modifying the measuring apparatus, in such a way that the test results obtained were repeatable, the reliability of the instrument and the method of testing was proved.



### Trillingsprobleme

Belangrike diens in die vorm van 'n ondersoek van trillingsprobleme kon aan die nywerheid bewys word.

Die volgende probleme is na die Instituut verwys en is met goeie gevolg opgelos.

Om aan die vereistes van die Suid-Afrikaanse Lugraad te voldoen, is onder verskillende vliegtoestande die trillingsenskappe van 'n hulpdraer aan die agterstewe van 'n prospekteervliegtuig ingebou, vir 'n groot Randse mynkorporasie vasgestel.

'n Firma in Noord-Rhodesië is van raad gedien in verband met die verwydering van trillings in hul uraanherwinningsfabriek. 'n Dergelike probleem het in die diamantherwinningsfabriek van die delwerybedryf voorgekom, waar die bron van die trillings in die gebou vasgestel is.

'n Ontploffingstegniek, bekend as „millisekonde-ontploffing”, is jare reeds in oorsese koolmyne in gebruik. Tydens sommige van die eerste toetse in Suid-Afrika waarin hierdie tegniek gebruik is, het die Instituut die uitwerking van die trillings wat as gevolg van „millisekonde-ontploffing” voorgekom het, gemeet. Hierdie toetse is op die dakwand van 'n steenkoolmyn gedoen om te bepaal of die trillings skadelik is of nie.

In nog 'n ondersoek is die oorsaak van die swigting van kompressorwaaiers weens vermoeidheid as gevolg van trillings vasgestel.

### Vergruising en Verpoeiëring

Vergruising en verpoeiëring dek die hele gebied van die reduksie van materiale in kleiner fragmente deur middel van prosesse soos sny, masjineer, boor, slyp en skietwerk. Heelwat navorsingswerk word in die buiteland gedoen met die masjienbewerking van metale, maar die slyp en boor van nie-metale, soos byvoorbeeld rots, geniet nie veel aandag nie. Dit word as belangrik beskou dat hierdie aspekte van vergruising weens die betrekking op die myn- en sementnywerhede, in Suid-Afrika ondersoek moet word.

Met die ondersoek van metodes om die energie te meet wat 'n skokboor gebruik om 'n gat in rots te boor is reeds bevredigende resultate verkry.

Ondersoek is ook ingestel op die gebied van vergruising ten einde van grondbeginsels die presiese meganisme van die slypproses in koeël- en silindermeulens af te lei en dan later bestaande tegnieke op hierdie gebied te ontwikkel.

### Ontwerp van 'n Radarmas

'n Radarmas wat in die tekenkantoor van die Instituut namens die Nasionale Telekommunikasie-navorsingslaboratorium vir die Departement van Verdediging ontwerp is, is gebou en by een van die Suid-Afrikaanse Lugmagstasies aan die begin van 1957 geïnstalleer. Meganiese moeikhede is aanvanklik ondervind, maar as gevolg van veranderings wat in die afgelope jaar aangebring is, werk die mas nou bevredigend.

### Vibration Research

The investigation of vibration problems was an important service the Institute could offer to industry. Among the vibration problems successfully solved were the following: in order to satisfy the requirements of the Air Council, the vibration characteristics of a special tail unit fitted to an aircraft used for prospecting purposes by a large mining group were determined under various flying conditions.

Advice was given on the elimination of vibrations occurring in a uranium recovery plant building in Northern Rhodesia, and on a similar problem occurring in the diamond recovery plant of a diamond digging establishment.

A blasting technique, known as “milli-second blasting” has been used in coal mines overseas for many years. In some of the first tests using milli-second blasting in South Africa, the vibrations set up in the roof of the underground workings were measured at a colliery, to determine whether the effect of this method of blasting would be deleterious to the mine roof or not.

In another investigation the fatigue failure of an impeller caused by vibration, was successfully explained.

### Comminution and Grinding

The subject of comminution and grinding embraces the whole field of the reduction of materials to smaller fragments by such processes as cutting, machining, drilling, grinding and blasting. Much research is being conducted overseas into the machining of metals but little work has been, or is being done, on the grinding and drilling of non-metals such as rock. An investigation into this aspect of comminution was considered to be important because of its bearing on the mining and the cement industries in South Africa.

Investigations into the methods of measuring the energy used by a percussion drilling machine in drilling rock were continued. As a result of this work a satisfactory method for measuring this energy was devised.

An investigation was also initiated into the subject of grinding, with the object, firstly, of establishing from fundamental principles the exact mechanism of the grinding process in a ball or tube mill, and secondly, of developing improved techniques in this field.

### Design of Radar Aerial

A radar aerial, the mechanical parts of which were designed by the Institute on behalf of the National Telecommunications Research Institute for the Department of Defence, was manufactured and installed at an Air Force Station early in 1957. Initial mechanical difficulties were encountered but as a result of modifications made during the period under review, it has since operated satisfactorily.



### **Verwerking van Munisipale Afval in Kompos**

'n Proefaanleg om munisipale afval in kompos om te skep, is deur die Instituut ontwerp. Die komposmasjien is gebou en word hopelik in April 1958 in Pretoria opgestel.

Hierdie aanleg is bloot 'n proefneming om te bewys dat materiaal, soos huis- en straatafval en ander afval waarmee die munisipaliteite dwarsdeur die land hoe langer hoe groter verwyderingsprobleme het, op 'n ekonomiese basis in kompos omgeskep kan word. Die inhoudsmaat van die eenheid is 6 ton per dag. Die koste van die aanleg word deur die Pretoriase Stadsraad gedra.

### **Toetse met Proefmynskagprop**

Omdat een van die goudmyne in die Oranje-Vrystaat oorstroom is as gevolg van 'n breuk in 'n betonprop in een van sy vertikale skagte geïnstalleer, is 'n ondersoek van die werkverrigting van skagproppe deur een van die Randse mynkorporasies ingestel. 'n Versoek is aan die Instituut gerig om dié deel van die navorsing wat betrekking het op die meting van die spanning in die rots rondom die eksperimentele prop, te onderneem. Uit die resultate van die ondersoek blyk dit dat die druk van die water agter die prop klein skeurtjies in die rots veroorsaak het wat waarskynlik die rede vir die breuk in die prop in die Vrystaatse goudmyn was.

### **Rotsstortings en Stratabewegings in diep Mynbou**

Navorsing op die gebied van rotsstortings en stratabewegings in diep mynbou, wat namens die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese uitgevoer word, het gedurende die tydperk onder bespreking gevorder.

Ten einde praktiese gegewens in verband met die voorkoms van rotsstortings vir uiteindelijke statistiese ontledings toeganklik te maak, is reëlings getref om alle gegewens oor rotsstortings in vyf groot myne wat met die stortingsprobleem te kampe het, op Hollerithkaarte aan te bring.

In die loop van 'n studie van die toestand van die grond rondom ondergrondse uitgrawings is gegewens versamel oor die voorkoms, omvang en aard van gekraakte rotssones wat rondom ondergrondse uitgrawings voorkom. Dieselfde probleem word uit 'n teoretiese oogpunt benader deur die spanningsverdeling rondom ondergrondse uitgrawings, op grond van die elastisiteitsteorie te ontleed en sones vas te stel waar die spanning die sterkte van die rots oorskry en dus die rots laat kraak. In die geval van uitgrawings met 'n eenvoudige vorm kan matematiese ontledings toegepas word. Indien die uitgraving egter 'n onreëlmatige vorm het, word foto-elastiese metodes toegepas. Die verandering van spanning in die rots voor 'n vorderende werksfront is in twee delf-

### **Composting of Municipal Wastes**

On behalf of the National Chemical Research Laboratory, a pilot plant for composting municipal waste materials was designed by the Institute. The manufacture of the plant was completed and it was scheduled to be erected in Pretoria during April, 1958.

This pilot plant is a purely experimental unit to demonstrate the possibilities of composting on an economic basis such materials as household refuse, garbage, and street sweepings, the disposal of which, municipalities throughout the country are finding an increasingly embarrassing problem. The plant has a capacity of 6 tons per day. The plant was financed by the Pretoria City Council.

### **Experimental Mine Shaft Plug**

As a consequence of the flooding of a gold mine in the Orange Free State due to the failure of a concrete plug installed in one of the vertical shafts, an investigation into the behaviour of plugs was initiated by one of the large mining groups. The Institute was called upon to undertake that part of the investigation which had as its object the measurements of the movement in the rock surrounding an experimental plug. The results showed that pressure behind the plug caused opening of fissures in the rock. This is probably the reason, or at any rate, one of the reasons, for the failure of the plug in the mine.

### **Rockbursts and Strata Movement in Deep Level Mining**

During the period under review research into rockbursts and strata movements in deep level mining was continued on behalf of the Transvaal and Orange Free State Chamber of Mines.

Arrangements were made for all the data relating to the occurrence of rockbursts in five large gold mines to be punched on Hollerith cards. This will considerably facilitate future statistical analysis of these data.

In the course of a study into the condition of the ground surrounding excavations at depth, evidence was found of the existence and of the shape and size of the fractured zone of rock which develops around mining excavations. A theoretical determination of the configuration of the fracture zones was also attempted by applying the theory of elasticity to determine the distribution of stresses around underground excavations. In this analysis zones where the stress exceeds the strength, and where the rock therefore becomes fractured, can be determined. Where the geometrical cross-sectional shape of the excavation is simple, mathematical analyses can be employed, but where the excavations are of a complex form the distribution of the stresses in the rock is obtained using photo-elastic methods. Measurements of the changes in stress in the rock ahead of an advancing



plekke van die E.R.P.M. gemeet met behulp van meetselle wat in boorgate in die rots geïnstalleer is. Om vas te stel of en hoe die spanning in die rots voor die werksfront en die mate van vernouing van die delfplek mekaar beïnvloed, is insakmeters in die toetsdelfplekke geïnstalleer.

Die toestand van die grond rondom uitgrawings is ook ondersoek deur die beweging van rotslae bo en onder ondergrondse uitgrawings te meet. Die ontleding van sulke metings wat in die myne Harmony en Robinson Deep gedoen is, toon hoe die beweging in die rotslae uitbrei namate die uitgrawings groter word.

Die bepaling van druksterkte en elastiese konstante van verskillende rotslae wat in die Witwatersrandse goudmyne voorkom, is voortgesit. Die ondersoek mik daarop om vas te stel hoe die voorkoms van rotsstortings deur sekere eienskappe van die rots beïnvloed word.

Om die aard van rotsstortings en die oorsake daarvan te ondersoek, het lede van die navorsingsgroep volgehou met ondergrondse besoeke aan delfplekke waar stortings voorgekom het. Gereelde vergaderings is by etlike myne gehou om die oorsake, aard en hewigheid van rotsstortings wat voorkom, met die mynbeamptes te bespreek.

In die verlede het die navorsingsgroep 'n metode ontwikkel om rotsstortings te bekamp deur ontspanningsgate in die werksfront te boor en te laat ontplof. Die aanwending van hierdie metode in etlike myne brei uit en die resultate is bemoedigend. 'n Verhandeling oor hierdie werk is gepubliseer.

Daar is ook voortgegaan met die ontwikkeling van akoestiese instrumente deur die Nasionale Fisiese Navorsingslaboratorium om die omvang en graad van die verbrokkeling van 'n werksfront te bepaal. Hierdie werk is belangrik nie alleen om kennis in te win oor die omvang van 'n gebreekte rotsone rondom uitgrawings nie, maar ook om die sukses van die bogenoemde ontspanningstechniek regstreeks te meet.

## HITTEVOORTPLANTING

### Hitte-oordragingskoeffisiënt van Gevinde Buise

Die oprigting van die staalstruktuur vir die windtunnel met temperatuur en vogbeheer, wat spesiaal vir hierdie projek ontwerp is, is in die afgelope jaar voltooi. Die windtunnel is vir ander ondersoeke gebruik terwyl die beheerstelsel gebou word. Twee tenks van 1000 gelling elk vir die warm- en kouwatertoevoer is voltooi, en 'n aanvang is gemaak met die installering van die beheerstelsel, pype, ens.

Hoewel dit nie moontlik was om 'n volledige yking van die lugvloei in die tunnel uit te voer nie, het voorlopige toetse getoon dat die lugverdeling in die toetsdeel uitstekend is.

Stope face were carried out in two stops in the East Rand Proprietary Mines by means of strain cells installed in boreholes drilled in the rock. To determine whether any relationship exists between changes of stress in the rock ahead of the face, and the rate closure of the stope, recording closure meters were installed in the stope.

The condition of the ground around excavations was also studied by measuring the movement of the strata above and below excavations. An analysis of measurements made in the Harmony and Robinson Deep Mines clearly indicated how the area affected by movement increased as the size of the excavations increased.

Tests to determine the compressive strength and elastic constants of the various strata encountered in the mines of the Witwatersrand were continued. The object of this work is to determine how the incidence of rockbursts is influenced by the properties of the rock. Members of the research team continued to make visits to the actual sites of rockbursts in order to gain an intimate insight into the nature and causes of rockbursts. Regular meetings were also held at some mines to discuss, with the mine officials, the possible causes and other aspects of rockbursts which had occurred on their mines.

Use of the technique, known as "de-stressing", which had been developed by the Research Team to combat rockbursts, continued successfully and on a larger scale. A paper on this work was published during the year.

The development of sonic and ultrasonic instruments for determining the extent and degree of fracturing of a stope face was continued by the National Physical Research Laboratory. This work is important, not only because it should yield information on the configuration of the fracture zone, but it should also enable the effectiveness of a "de-stressing" blast on the face to be measured.

## HEAT TRANSFER

### Rating of Finned Tubing

The erection of a steel structure and ducting for the temperature and humidity controlled windtunnel, specifically designed for determining the rating of finned tubing, was completed during the past year. Use was made of the windtunnel for other studies while the control system for temperature and humidity was being built. Two 1,000 gallon tanks for the hot and cold water supplies were completed, and a start was made on the installation of the control system, pipe work, and other equipment.

While it was not possible for a complete calibration of the air flow distribution in the tunnel to be carried out, due to the urgent use of the tunnel for other work, preliminary traverses showed that the velocity distribution in the test section was very good.



### **Studie van Hitte-uitruilingskoeffisiënt by Hoë Temperature**

'n Studie is gemaak van die literatuur in verband met die hitte-oordraging tussen vaste wande en vloeibare metale, en die gegewens in 'n interne memorandum opgesom. 'n Tweede memorandum, oor die hitte-oordrag op vaste partikels in 'n vloeistof wat in pype vloei, is opgestel.

### **Meet van Snel-wisselende Temperature**

Die meting van temperature wat by wissel tussen 100°C en 1000°C teen 'n frekwensie van sowat 200 Hertz, bied 'n wesentlike probleem. 'n Voorbeeld van dié temperatuurskommelings is die resonerende verbrandingskamer wat op die oomblik deur die Onderafdeling Termodinamika ondersoek word.

Om die nodige grondslag vir die probleem te lê en die doeltreffendste toetsprogram uit te werk, is 'n oorsig van beskikbare gegewens gemaak en in 'n interne verslag opgesom.

### **Ontwerp van 'n Menskalorimeter**

Teen die einde van die afgelope jaar is die Instituut deur die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese versoek om voort te gaan met die ontwerp van 'n vereenvoudigde gradiëntlaagkalorimeter. Hierdie kalorimeter sal gebruik word vir die bepaling van die berging van hitte in die menslike liggaam wanneer dit blootgestel word aan uiterste omgewingstoestande in strawwe fisiese inspanning. Waar die oorspronklike Benzinger-kalorimeter, wat eintlik vir partisionele kalorimetrie bedoel was, ingewikkelde beheerstelsels vir die noukeurige reëling van doptemperatuur, lugtemperatuur en vogtigheid vereis, en die hitte in die lugstroom volgens 'n ingewikkelde nulmetode gemeet word, sal daar in die vereenvoudigde kalorimeter geen beheer oor doptemperatuur wees nie. Die bepaling van die hitte in die lugstroom is ook aansienlik vereenvoudig. Die kalorimeter is 'n waardevolle hulpinstrument vir die sogenaamde metode van parsieële of gedeeltelike kalorimetrie of vir die regstreekse hittebepalingsmetode wat tans ontwikkel word.

'n Begin is reeds gemaak met die ontwerp van die kalorimeterdop en sy voetstuk. Die hoofklem val egter op die ontwikkeling van 'n nuwe tipe gradiëntlaaghittemeter, wat afwyk van die oorspronklike Benzinger-tipe deurdat gebruik gemaak word van weerstandstermometer-roosters in plaas van die serieskoppeling van termokoppels. Voorlopige toetse het getoon dat die gewysigde tipe net so goed is as die Benzinger-tipe. Terselfdertyd sal konstruksieprobleme heelwat verlig word en aansienlik tyd bespaar word deur die gebruik van die nuwe tipe.

### **Die Hitteverlies van die Menslike Liggaam in verskillende Klimaatstoestande**

Na voltooiing van die eerste fase van die ondersoek na die regstreekse bepaling van die hitteverlies uit die

### **Heat Transfer Coefficients at High Temperatures**

A survey of the literature on the transfer of heat between solid boundaries and liquid metals was made and compiled in summary form in an internal memorandum. A second memorandum was drawn up to cover the literature on the transfer of heat to a slurry, consisting of a suspension of solid particles in a liquid flowing in pipes.

### **Measurement of Rapidly Fluctuating Temperatures**

The measurement of temperatures fluctuating between, say, 100°C and 1000°C with frequencies of the order of 200 c.p.s. presents a real problem. An example of such temperature fluctuations may be found in the resonating combustion chamber, at present being studied by the Thermodynamics Section.

To obtain the necessary background to the problem and to plan the most effective programme for an investigation, a survey of the literature available on the subject was made and summarized in an internal report.

### **Design of a Human Calorimeter**

Towards the end of the year, the Institute was requested by the Transvaal and Orange Free State Chamber of Mines to proceed with the design of a simplified gradient layer type of calorimeter for the measurement of the storage of heat in the human body when exposed to severe environmental conditions and engaged on strenuous tasks. Whereas the original Benzinger calorimeter, intended primarily for partitional calorimetry, involves intricate control systems for the close regulation of shell surface temperature, air temperature and humidity, and embodies a complicated null-method for the measurement of heat in the air, there will be no control over the shell temperature in the simplified calorimeter. The measurement of heat in the airstream is also considerably simplified. It is thus a valuable auxiliary instrument in the so-called method of partitional calorimetry or in the direct measurement methods at present being developed.

A start was made on the design of the calorimeter shell and supporting structure. The main emphasis, however, was placed on the development of a new type of gradient layer heat-meter. This instrument differs from the original Benzinger calorimeter in that it uses resistance thermometer grids in the heat meter instead of thermo-couples connected in series. Preliminary tests showed that the modified type was as good as the Benzinger type. Constructional problems will also be greatly reduced and considerable time will be saved with the new instrument.

### **Heat Loss from the Human Body under Different Environmental Conditions**

Upon completion of the first phase of the investigation into the direct measurement of the heat loss from a



menslike liggaam, het dit inderdaad moontlik gelyk om die konveksie- en verdampingsverliese van modelle in 'n windtonnel, binne die vereiste noukeurigheidspere te meet. Derhalwe is voorgestel dat die tweede fase van die ondersoek voortgesit word. Dit sal die ontwikkeling van instrumente meebring wat vir die regstreekse bepaling van die hitteverlies deur konveksie, verdamping en straling uit 'n werklike proefpersoon, geskik is.

Verdere studies vir die ontwerp van die volskaalse apparaat is met modelle gemaak om die invloed wat vrystroom-turbulensie, onegalige verhitting van die model en die lengte-wydte-verhouding op die noukeurigheid het, vas te stel. In die loop van hierdie toetse is 'n nuwe metode vir die regstreekse meting van die konveksieverlies ontwikkel. Hierdie metode is meer geskik as die semi-empiriese metode wat tot dusver toegepas is.

'n Model van die integrerende  $4\pi$ -stralingsmeter vir gebruik by die bepaling van die stralingshitteverlies is ook ontwerp en word tans gebou.

Die meting van die veltemperatuur van 'n proefpersoon in toestande van hoë vogtigheid, vereis 'n instrument met 'n meetelement-temperatuur heelwat hoër as die doppunt van die lug in die toetskamer. 'n Stralingsmeter wat aan hierdie vereistes voldoen, is gebou vir toetse in die klimaatskamer. Die temperatuur kan by enige willekeurige waarde gekontroleer word. Die kontrole wat outomaties aan- of afskakel is sodanig dat die referensieverbindings van die termosuil konstant gehou kan word binne  $0.05^{\circ}\text{C}$ , wat noukeurige aflesings in die hand werk.

Drie rektale termokoppels is ook vir gebruik op proefpersone in die klimaatskamer vervaardig.

#### **Studie van Sonenergieversamelaars**

Verskeie projekte insake die gebruik van sonenergie is gedurende die jaar voortgesit.

'n Betreklik eenvoudige en goedkoop waterdistillasie-eenheid vir fundamentele ondersoeke is ontwikkel, en toetse daarmee is aan die gang. 'n Belangrike gevolgtrekking in verband met son-watervarmers is, dat uitgebreide gebruik van sonenergie vir verwarming van water in Suid-Afrika op ekonomiese grondslag alleen moontlik gemaak kan word deur die goedkoop massa-produksie van plat absorberende plate met ingeboude waterdraende buise.

#### **Vernietiging van Banknote**

Na oplossing van die probleem om 'n gestadige, egalige toevoer van note teen die vereiste tempo na 'n hamermeul te verseker, is die volledige aanleg ontwerp. In hierdie aanleg is dit moontlik om bondels note, wat in 'n geslote bak geplaas word, na die hamermeul te voer en tot poeier te maal. Die poeier word dan deur 'n lugstroom na 'n nat sikloonmenger vervoer, waar 'n pap gevorm word wat in die munisipale rioolstelsel gepomp kan word.

human body, it was considered feasible to measure the convective and evaporative heat losses from models in a windtunnel to within the specified limits of accuracy. Consequently, it was recommended that the second phase of the investigation should be undertaken. This will involve the development of instruments suitable for the direct measurement of the heat loss by convection, evaporation and radiation from an actual human subject.

Further studies on models were made prior to starting with the design of the full-scale apparatus. The model studies aimed at establishing the effects of free stream turbulence, uneven heating of the model and aspect ratio on the accuracy of the results. During these tests, a new method for the direct measurement of the convective component was developed. This method is superior to the semi-empirical method used up to the present.

A model of the integrating  $4\pi$  radiometer to be used for radiation loss measurements was also designed and is being constructed.

For the measurement of skin temperature by means of a radiometer under high humidity conditions, it is necessary to use an instrument in which the measuring elements are kept at a temperature well above the dew point of the surrounding air. A radiometer, using this principle, was built for tests in the climatic chamber. Its temperature is controllable at any desired value. The control, of the "on-off" type, is such that the reference junctions of the thermo-pile are kept constant to within  $0.05^{\circ}\text{C}$  and consequently results in accurate readings.

Three rectal thermocouples were also made for use on subjects in the climatic chamber.

#### **Solar Energy Collectors**

Several projects involving the use of solar energy were continued. A relatively simple and cheap water distillation unit was developed and is undergoing tests. An important point in connection with solar water heaters is that, because of the high labour costs involved, the extensive use of solar energy for heating water in South Africa must await the availability of mass-produced flat absorbing plates with integral water-carrying tubes.

#### **Destruction of Banknotes**

After solving the problem of obtaining a steady and uniform feed of banknotes at the desired rate to a hammer-mill, a complete banknote destruction plant was designed which will enable bundles of notes, deposited in a locked hopper, to be transported to the mill and pulverized. The resulting powder is then pneumatically conveyed to a wet cyclone-mixer, where a pulp is formed that may be pumped into the municipal drain.



Volledige werkstekeninge en spesifikasies van die aanleg is in die instituut se tekenkantoor vir tenderdoeleindes voorberei, en die aanleg word tans gebou.

## LUGVERSORGING EN -VERKOELING

### Voorstelling van Klimaatgegevens vir gebruik in die ontwerp van Lugversorgingstoerusting

Vir die samestelling van klimaatgegevens in 'n vorm wat vir gebruik by die ontwerp van lugversorgingstoerusting geskik is, moet die gebruiksvereistes in ag geneem word. Daar is dus besluit om die klimaatgegevens so saam te vat dat spesifieke besonderhede met weinig verdere moeite daaruit verkry kan word.

Die verskillende metodes van ontleding, wat alreeds in ander lande in gebruik is, is ondersoek maar blykbaar is geen metode wat toepaslik is op Suid-Afrikaanse toestande geskik geag nie. Die ondersoek na 'n geskikte metode word egter bemoeilik deur gebrek aan gegevens, veral oor die hitte-oordraging in swaar strukture in Suid-Afrikaanse toestande. Totdat die klimaatgegevens in die gewenste vorm beskikbaar is, moet gegevens verkry word uit ontleding van warm en koue dae op lugtemperatuur gebaseer saam met gegevens oor vog en sonstraling vir dieselfde dae.

### Meet van Voggehalte van Lug

Toetse vir die bepaling van die voggehalte van lug is met twee instrumente uitgevoer. Die een word die adiabatiese versadiger genoem en die ander die Hilsch-werwelbuis.

In die adiabatiese versadiger word die lug waarvan die voggehalte bepaal moet word, so met water gemeng dat die vermenging adiabaties plaasvind. Deur die ewewigstemperatuur van die mengsel en die droëbollugtemperatuur te bepaal kan die voggehalte van die lug bereken word. Die instrument bestaan uit 'n buis met dubbele glaswande wat versilwer is. Die ruimte tussen die wande is lugleeg om die hittevloei tot 'n minimum te beperk. Die buis is volgepak met natuurlike spons wat nat gehou word en waardeur 'n monster van die lug, waarvan die voggehalte bepaal moet word, gesuig word.

Uitgebreide toetse met die instrument is uitgevoer en dit het geblyk dat noukeuriger vogbepalings met die instrument gedoen kan word as met nat- en droëbolinstrumente. Dit het ook die verdere voordeel dat voortdurende aflesings oor 'n langer tydperk gedoen kan word as met die nat- en droëbolinstrumente, omdat die sponse baie langer as die putte wat in die nat- en droëbolinstrumente gebruik word, nat bly.

Toetse wat met die Hilsch-werwelbuis uitgevoer is, dui aan dat die temperatuurverskil tussen die twee uitlaatlugstrome 'n funksie van die voggehalte van die lug is. Teoretiese en eksperimentele ondersoek in verband met hierdie metode van vogmeting word voortgesit.

Verskeie ander metodes vir die bepaling van die voggehalte van lug word ook ondersoek.

Full working drawings and specifications of the plant were prepared in the Institute's design office and work on the construction of the plant is now proceeding.

## AIR CONDITIONING AND REFRIGERATION

### Presentation of Climatic Data for Use in the Design of Air Conditioning Installations

Because of the difficulty of compiling climatic data in a simple form which can be used directly in the design of air conditioning installations and which are to comply with the requirements of any particular application, it was decided that the data should be compiled in such a form that any specific information could be extracted from it with little further effort.

The various methods of analysing climatic data at present used in other countries were studied but none was considered suitable for South African conditions. The development of a method suitable for South African conditions is hampered by lack of local data, especially concerning the transmission of heat in heavy structures. Until climatic data are available in the desired form, information for designing air conditioning installations has to be derived from an analysis of warm and cold days taking air temperatures as a basis, together with information on the humidity and solar radiation on these days.

### Measurement of the Humidity of Air

Tests were conducted with two new instruments developed for measuring the humidity of air. One is the adiabatic saturator and the other the Hilsch vortex tube.

In the adiabatic saturator the air, the humidity of which is to be determined, is mixed with water in such a way that the mixing takes place adiabatically. By measuring the equilibrium temperature and dry-bulb temperature of the air the humidity of the air can be determined. The instrument consists of an evacuated double glass walled tube, silver plated to reduce the heatflow to a minimum. The tube is packed with natural sponge which is kept wet and through which the air is drawn. Extensive tests were conducted with this instrument and it was found that with it more accurate humidity determinations could be made than with wet and dry bulb instruments. A further advantage is that continuous readings can be made over longer periods because the sponges used remain wet much longer than the wicks used in the wet and dry bulb instrument.

Test results obtained with the Hilsch vortex tube indicated that the temperature difference between the two exhaust air streams from the tube is a function of the humidity of the air. A theoretical and experimental investigation of this method is in progress.

Other methods for measuring the humidity of air are also being investigated.



### **Tegniese diens aan die Kamer van Mynwese in verband met die Klimaatkamer**

Die klimaatkamer, wat deur hierdie Instituut ontwerp is, is aan die begin van 1957 in gebruik geneem. Aangesien die Kamer van Mynwese tydelik hulp nodig gehad het om die klimaatkamer in bedryf te hou, is hierdie Instituut versoek om 'n ingenieur vir die doel beskikbaar te stel tot tyd en wyl 'n geskikte persoon gevind en opgelei kan word.

Enkele probleme in verband met die werking het voorgekom. 'n Probleem wat byvoorbeeld aangepak moes word het ontstaan weens vuiligheid in die glycolwatermengsel. Dit is opgelos deur 'n opgaartenk van 5,000 gelling buite die gebou op te rig en 'n filtreertoestel te installeer.

Nog 'n probleem het voorgekom as gevolg van 'n temperatuurvariasie van 8°F in die beginstadium in die warm tenk. Dit is opgelos deur die meetelement van die kontrolestelsel te verplaas, waardeur die temperatuurskommeling bevredigend verminder het.

### **Bepaling van die Voggehalte van Lug in die Klimaatkamer**

'n Versoek is van die Kamer van Mynwese ontvang vir die vervaardiging van 'n vogmetingsinstrument vir algemene gebruik in die klimaatkamer. 'n Adiabtiese versadiger, soos elders in hierdie verslag beskryf, is voltooi en word eersdaags aan die Kamer oorhandig.

### **Lugversorging by die Kalorimeter en Beheerkamers van die Klimaatkamer**

Die ontwerp van 'n lugversorgingstelsel vir die kalorimeter en beheerkamers van die klimaatkamer word op versoek van die Kamer van Mynwese uitgevoer. Aangesien die temperatuur en die voggehalte van die lug wat vir die kalorimeter nodig is besonder akkuraat beheer moet word, is die probleem vir ondersoek na die Instituut verwys.

### **Verhittings- en Verkoelingsprobleme in Verband met Southerwinning**

Op versoek van 'n private onderneming is uitgebreide metings van klimaatsfaktore oor 'n soutpan in Wes-Transvaal gedoen, ten einde 'n metode te bepaal om, gegewens te verkry oor die klimaatstoestand in 'n soutproduserende gebied, met die oog op die vaststelling van die mate waarin natuurlike energiebronne gebruik kan word vir soutproduksie uit die soutwater in hierdie gebied.

Benewens hierdie ondersoek sal die ekonomiese aspekte van meganiese verhittings- en verkoelingsmetodes ook ondersoek word.

### **Ander Dienste**

Die vernaamste diens wat onder andere aan die nywerheid gelewer is, is die ondersoek van die lugversorgingsprobleme in die gebou van die Raad van Beheer

### **Technical Service to the Chamber of Mines**

The climatic chamber, designed in the Institute, has been in use since the beginning of 1957. The Institute was approached by the Chamber of Mines to supply the services of an engineer to assist with the operation of the plant until a suitable engineer could be employed and trained.

Some operational problems were encountered. One problem, for example, which arose from the presence of dirt in the glycol moisture was solved by erecting a 5,000 gallon storage tank outside the building and installing a suitable filter unit. The rather wide temperature variation of 8°F which occurred in the hot tank also created a problem in the early stages, but this was solved by changing the position of the sensing element of the control system. This decreased the temperature variation to a satisfactory level.

### **Measuring the Humidity of Air in the Climatic Chamber**

A request was received from the Chamber of Mines to supply a humidity instrument for general use in the climatic chamber. An adiabatic saturator described elsewhere in this report was constructed and will be handed over to the Chamber shortly.

### **Air Conditioning of Calorimeter and Control Rooms**

The design of an air conditioning plant for the calorimeter and control room of the climatic chamber was undertaken at the request of the Chamber of Mines. The problem was referred to this Institute because the specifications called for very accurate control of the humidity and temperature of the air.

### **Heating and Cooling Problems of Salt Production**

At the request of a private firm, extensive measurements were made of the climatic conditions over a certain salt pan in the Transvaal. The purpose was to obtain some information on the climatic conditions in a salt producing area in order to assess to what extent natural energy sources could be used for the production of salt from the brine which is found in these areas. The economic aspects of mechanical heating and cooling methods will also be investigated.

### **Other Services**

Of the other services rendered to industry, the most important was an investigation into air conditioning problems encountered in the building of the Control



oor die Vee- en Vleisnywerheid. Die ondersoek sowel as die verslag daaroor is voltooi en aan die opdraggewer voorgelê.

Advies en hulp is ook aan verskeie universiteite in verband met spesiale lugversorgingsprobleme aan Staatsdepartemente, munisipaliteite, banke met lugreëlingsprobleme in verskeie gebiede in Afrika, en aan privaat maatskappye verleen.

## TERMODINAMIKA

Gedurende die jaar is daar onderhandelings gevoer met die Suid-Afrikaanse Lugdiens om 'n kragerwinnings-turbine vir die laboratorium te verkry. Hierdie turbine word binnekort opgestel met drie resonansverbrandings-kamers wat eers van vloeibare brandstof gebruik sal maak, maar later verpoeierde steenkool sal gebruik.

### Gasturbineavorsing

Die werk word voortgesit in verband met 'n verbrandingskamer wat verpoeierde steenkool as brandstof gebruik. Met die oog hierop word 'n termoakoestiese resonator ontwerp wat 'n intensiewe klankgolfveld sal verskaf waarin die asdeeltjies ôf opgebreek word sodat hulle deur die turbine kan beweeg sonder om skade te veroorsaak, ôf deur samepakking van die fyn partikels makliker deur as-afskeiers uitgehaal kan word.

Ontwikkelingswerk word nog voortgesit in verband met die snelheidsresonansie-eenheid en 'n groter eenheid word gebou. Die resonator word gebruik om die verbranding as sodanig te ondersoek. Dit het geblyk dat 'n vlamhouer vir stabiele verbranding vereis word. As gevolg van 'n reeks toetse is 'n vlamhouer ontwerp wat verbrandings-stabiliteit ten opsigte van talle brandstowwe gee. Deur gebruik te maak van hierdie vlamhouer kan die brandstof aanhoudend, in plaas van met die vroeëre pulserende toevoer ingespuut word. Die resonator is ook getoets by toevoer van die vloeibare brandstof onder lae druk. Die eerste toetse het belowende resultate gelever en die toetsreeks word voortgesit. 'n Toestel is ook gebou om die gasdinamiese eienskappe van die inlaatmondstuk te bestudeer.

Dit lyk of die toevoer van klein hoeveelhede verpoeierde steenkool na die verbrandingskamer moeilikheid gaan oplewer. As die steenkool te fyn gemaal is, d.w.s. 90 persent—200-maas, vervloei dit nie maklik nie en die steenkool loop nie egalig uit die voerpyp nie. Word 'n growwe steenkool gebruik, raak die klein pype gou deur partikels verstop. Dit lyk of 'n belowende metode sal wees om die growwe steenkool deur 'n voorraadtenk met meganiese roerder na 'n vibrator en van daar na 'n stroom saamgeperste lug te voer, waar die partikels verder verpoeier word voordat hulle in die verbrandingskamer kom. Twee metodes van verpoeiering word gebruik. 'n Mondstuk word in die voerpyp geplaas waardeur die steenkool-lugmengsel versnel word. Daarna word dit ôf teen 'n harde staalvoorwerp gerig waar die

Board for the Live-stock and Meat Industries. This investigation was completed and a report submitted to the sponsor.

Advice and assistance on special air conditioning problems were given to universities, government departments, municipalities and banks in several areas of Africa and also to private companies.

## THERMODYNAMICS

Discussions were held with the South African Airways with a view to obtaining a power recovery turbine for the laboratory. This turbine will shortly be installed with three resonating combustion chambers using liquid fuels in the first instance, but eventually using powdered coal.

### Gas Turbine Research

Work continued on a combustion chamber that is being developed to burn pulverized coal. To this end a thermo-acoustic resonator is being developed to provide a field of intense sound waves, in which the ash particles will either be broken up so that they pass through the turbine without causing any damage, or the fine particles will be agglomerated so that they can be more easily removed by ash separators.

Development work continued on the velocity resonance unit for the purpose of studying the combustion as such, and a larger unit is being built. The tests clearly revealed that a flame-holder was necessary for stable combustion. As a result of a series of tests a flame-holder was developed which gave stable combustion over a wide range of fuel flows and by its use it was possible to inject fuel continuously as opposed to the pulsed feed previously employed. This unit was also fed with a liquid fuel at low pressure, the first tests being very encouraging. An experimental test rig was also constructed for the study of the gas dynamic properties of the inlet nozzles.

Some difficulty is anticipated in feeding small quantities of pulverized fuel into the combustion chamber. If the coal is ground too fine, e.g. 90 per cent—200 mesh it does not fluidize properly and does not run evenly from the outlet pipe; if larger particles are present, the small feed pipes soon become blocked. One promising solution appears to be to feed the coarsely ground coal from a hopper-cum-mechanical stirrer on to a vibrator from whence it drops into a compressed air supply line and the particles are further pulverized between this supply point and the combustion chamber. Two methods of pulverization are being used. A nozzle is placed in the coal-air stream and the particles are accelerated. Hereafter they are either directed against a hardened steel target where they are broken up by impact or they are fed tangentially into a so-called cycloniser—a metal cylinder



partikels deur botsing opgebreek word; òf die stroom word in 'n sogenaamde sikloonvergruiser gevoer waar dit vinnig ronddraai en deur afskuring verpoer word. Toetse met die eerste tipe was effens ontmoedigend weens die verstopping van die mondstuk; maar tans word die sikloonvergruiser gebruik wat meer belowend skyn te wees.

'n Roterende steenkoolpomp is ontwerp om steenkool na 'n eksperimentele brander te vervoer en hierdie pomp sal ook gebruik word om dit na die verbrandingskamer te voer ingeval die vibrator-toevoerstelsel moeilik hede oplewer.

Die eerste eksperimentele werk in verband met die fundamentele ondersoek na die verbranding van poersteen- steenkool het begin en 'n fotografiese metode van vlamsnelheidbepaling is in die laboratorium ontwikkel. Uit hierdie toetse blyk dit of daar twee gebiede is waar verbranding plaasvind. In die eerste gebied word die vlugtige bestanddele van die steenkool verbrand en in die tweede word die vaste deel verbrand. Eksperimenteel is bewys dat die hoogste vlamsnelheid verkry word as die hoeveelheid primêre lug so gereël dat dit 'n stoïchiometrie- se verhouding vorm met die vlugtige bestanddele. Hierdie resultaat is regstreeks op die verbrandingskamer toegepas.

Die ontwikkeling van geskikte assekers is belangrik en heelwat werk is aan hierdie deel van die projek gedoen. Die assekers is van die sikloontipe en die veranderlikes in die ontwerp word ondersoek. Die jongste ontwerp vergelyk goed met die beste kommersiële assekers. Die werk is nou in 'n stadium waar 'n prototipe gebou kan word vir die lemerosietoerusting.

#### **Ondersoeke na die Verbrandingseienskappe van Plaaslik geproduseerde Brandstof**

Die eerste toetse met die vlamsnelheidsapparaat met poreuse skyf om die vlamsnelheid van gasvormige brandstowwe te bepaal, is met „Handigas”, 'n plaaslike produk, uitgevoer. Die gas is 'n mengsel van butaan en propaan en die persentasie butaan in die vrygestelde gas is afhanklik van druk, sodat die gas voortdurend van samestelling verander. Die laboratorium is nou besig om 'n gashouer te ontwerp waarin die „Handigas” onder 'n druk bewaar kan word wat dit gedurig in gasvorm hou.

#### **LUGDINAMIKA**

##### **Die Meting van lae Lugsnelhede**

Twee lugspoedmeters is ontwikkel vir spesiale metings in verband met die studie van lugdinamika en ventilasie.

Die eerste instrument is 'n warmdraadspoedmeter waarvan die meetelement op so 'n wyse ontwerp is dat die weergawe oor 'n wye reeks hoeke nie deur windrigting beïnvloed word nie. As gevolg van hierdie eien- skap, kan die instrument met voordeel gebruik word om

in which they are carried round at high speed and pulverized by attrition. Tests of the former type were a little discouraging due to the constant blockage of the nozzle and tests are now being carried out with the cycloniser which appears more promising.

A rotating coal-feed pump was developed to supply pulverized coal to an experimental burner and this pump will also be used to supply the combustion chamber should further difficulty be encountered with the coal-feed

The first experimental work in connection with fundamental investigations into the combustion of pulverized coal was carried out and a photographic method of flame speed determination was perfected. From these tests it would appear that there are two distinct regions in the combustion of the coal, the first being the region in which the volatile matter is burnt, then followed by the region in which the solid matter is burnt. It was shown experimentally that the highest flame speed occurred when the primary air quantity was regulated to form a stoichiometric mixture with the volatile matter. This result has been directly applied to work on the combustion chamber.

The development of ash separators is important and some work has been done on this aspect. The ash separators being developed are of the straight through cyclone type and variables in the design are being investigated. The present separator compares very favourably with the best commercial units and work has reached a stage where a prototype unit can be built for the blade erosion project.

#### **Combustion Properties of Locally Produced Fuel**

The first tests with the porous disc flame-speed determination apparatus were carried out with “Handigas”. This gas is a mixture of butane and propane and the percentage butane in the gas boiling off the liquid is continuously changing. The laboratory is at present constructing a gasholder where the “Handigas” can be stored at a pressure at which it remains gaseous.

#### **AERODYNAMICS**

##### **Measurement of Low Velocities**

Two anemometers were developed for special measurements in aerodynamic and ventilation studies. The first of these instruments is a hot-wire anemometer, in which the velocity sensing element is designed to be insensitive to flow direction over a wide range of angles. By virtue of this characteristic, the instrument can be applied with



spoedverdelings in geventileerde vertrekke te bepaal. Die spoedbereik strek van 0 tot 600 vt./min.

Die tweede spoedmeter is 'n verdere ontwikkeling van die vlerkmeule met luglaers. Die omwentelingspoed van die lemwiël word met behulp van 'n klein fotobuis en die reeds bestaande elektroniese teller bepaal, terwyl 'n verdere verbetering die meer doeltreffende instelling van die instrument onder stillugtoestande moontlik maak. Die verbeterde model word vir spoedmeting in die Kamer van Mynwese se Klimaatkamer gebruik, waar atmosferiese toestande oor wye perke wissel, en waar stromings in sowel horisontale as vertikale rigting gemeet word. Die instrument is geëyk oor 'n bereik van tussen 30 en 1200 vt./min.

### Lugweerstand in Mynskagte

Die projek behels 'n studie van die lugdinamiese weerstand van moderne sirkelvormige mynshagte, met die uiteindelijke doel om die weerstand te verminder deur verbeterde ontwerp van die interne strukture wat in sulke skagte gebruik word.

'n Spesiale windtonnel, wat ontwerp is om as model van 'n skag te dien, is opgerig en geëyk. Onmiddellik daarna is 'n uitgebreide reeks toetse teen 'n totale koste van £1,240 vir 'n myngroep uitgevoer. Altesaam twaalf verskillende ontwerpe en samestellings van interne strukture vir 'n beplande skag is bestudeer. Die bevinding was dat 'n aansienlike afname in skagweerstand deur geskikte ontwerp van die strukture verkry kon word.

Die projek word voortgesit met die onmiddellike doel om soveel moontlik basiese inligting aangaande die stromingstoestande in 'n skag en die weerstandseenskappe van balkstrukture in te win.

### Lugvervoer van Gekorrelde Stowwe

Moontlikhede word bestudeer om materiaal soos graan, meel, steenkool-as en sement op ekonomiese wyse met behulp van saamgeperste lug in pype te vervoer.

As gevolg van die sukses wat reeds met 'n 1-duimvervoerpyp, behaal is, is besluit om 'n verbeterde apparaat te bou waarin die doeltreffendheid van pype van verskillende groottes getoets kan word. Die nuwe apparaat het 'n geslote kringloop, sodat onafgebroke toetse met 'n beperkte hoeveelheid materiaal uitgevoer kan word. Die oprigting van die toestel nader tans voltooiing.

### Windtonnel-ontwikkeling

Goeie vordering is gemaak met die ontwerp van 'n supersoniese afblaas-windtonnel, met 'n toetsruimgrootte van 18 dm. × 18 dm. en 'n maksimum Mach-getal van 4.5.

Saamgeperste lug word onder 'n druk van 200 pd./vk. dm. in 'n groot lugtenk van ongeveer 2000 kub. vt. inhoud versamel, en word, na plotselinge oopstelling van 'n vleuelklep, deur die tonnel geblaas, waardeur die tonnel 'n onderbroke werking het. 'n Toets wat 16 sekonde duur sal elke twee ure teen die maksimum spoed uitgevoer kan word.

advantage to measure flow distribution in ventilated rooms. The speed range extends from 0 to 600 ft./min.

The second instrument is a further development of the vane anemometer with compressed-air bearings. The rotational speed of the rotor is measured by means of a miniature photo-electric tube, used in conjunction with the existing electronic counter. A further improvement provides for a more effective zero adjustment of the instrument under still air conditions. The improved prototype is being used for speed measurements in the Chamber of Mines' climatic chamber, in which atmospheric conditions vary over a wide range, and where it is required to measure both horizontal and vertical flows. The instrument has been calibrated for speeds ranging from 30 to 1200 ft./min.

### Airflow Resistance in Mineshafts

A study is being made of the aerodynamic resistance of modern, circular mineshafts, with the ultimate aim of reducing flow losses by means of improved design of the internal structure of shafts.

A special windtunnel, designed to serve as the scale model of a shaft, was erected and calibrated. An extensive series of tests was subsequently performed on behalf of a mining group. In all, twelve different designs and configurations of internal structures for a projected shaft were investigated, and results indicated that an appreciable reduction in shaft resistance could be effected by improved design of the structures.

Work on the project is being continued with a view to obtaining as much basic information as possible regarding flow conditions in shafts and the drag characteristics of bunt structures.

### Pneumatic Conveyance of Granular Materials

Possibilities are being studied of conveying materials such as grain, flour, coal-ash and cement economically by means of compressed air in pipes.

Following the success achieved with a 1-inch diameter conveyor, it was decided to construct an improved test rig in which various sizes of pipes could be tested. The new apparatus was designed as a closed-circuit unit, to permit of continuous testing with a limited amount of test material. Erection of the apparatus is nearing completion.

### Windtunnel Development

Good progress was made with the design of a supersonic blowdown windtunnel, which will have an 18 in. × 18 in. test section and a maximum Mach number of 4.5.

The large energy requirements associated with high speed flow are to be provided by pumping compressed air at a pressure of 200 p.s.i. into a storage tank of about 2,000 cub. ft. capacity. This air will then be released by a quick-acting butterfly valve to blow through the wind-tunnel, which will thus have an intermittent action. At maximum Mach number, a test of 16 seconds duration will be possible every two hours.



Die lugtenk en vleuelklep vir die tonnel is reeds bestel, asook die nodige lugfilters en 'n verkoeler. Tenders is ontvang vir 'n geskikte lugdroogstelsel en 'n hitte-uitruiler vir handhawing van die temperatuur in die lugstroom word ontwerp. Die lugdinamiese ontwerp van die sametrekkingsgedeelte en die supersoniese mondstukke is reeds afgehandel, sodat die werkstekeninge van hierdie onderdele nou deur die Instituut se tekenkantoor onderneem kan word.

#### **Meesleuring van Lug deur Lugstrale**

Verskeie lugdinamiese werktuie maak gebruik van 'n lugstraal om groot massas lug in beweging te stel. 'n Eksperimentele straalpomp, wat vir die kleiner lugvervoertoestel ontwerp is om die lugstroom te induseer, is deeglik ondersoek en, na aanleiding van die eksperimentele resultate, is 'n omvattende straalpompteorie ontwikkel. Hierdie teorie dien as grondslag waarvolgens straalpompe ontwerp kan word en is tewens gebruik om die groter pomp vir die nuwe lugvervoertoestel met geslote kringloop te ontwikkel. Laasgenoemde pomp is egter as eksperimentele model gebou met die doel om die straalpompteorie te ontwikkel.

#### **Lugweerstand van Gaasskerms**

Gaasskerms word algemeen in windtonnels en ander lugdinamiese werktuie gebruik om die kwaliteit van die stromende lug te verbeter.

'n Metode is ontwikkel waarvolgens die lugdinamiese weerstand van gaasmateriaal vinnig en akkuraat met behulp van 'n gevoelige sleepkragbalans bepaal kan word. Die nuwe metode lewer betroubare resultate tot by die laagste meetbare lugspeed.

#### **Ander Ondersoeke en Dienste**

Gedurende die verslagjaar is twaalf lugdinamiese meet-instrumente, waaronder manometers, pitotbuise, vloeimeters, en warmdraadspedimeters, ten behoeve van firmas en ander W.N.N.R.-laboratoria geëyk.

### **LUGDINAMIESE WERKTUIE**

#### **Waaiergeraas**

Die waaiergeraastoetstoestel, wat gebruik sal word in 'n ondersoek wat daarop gemik is om waaiergeraas by die oorsprong te verminder, is met sukses in werking gestel en 'n aanvang met die eksperimentele program gemaak.

Nadat die toetstelsel opgerig is moes oplossings eers gevind word vir verskeie ernstige probleme in verband met ongewenste trillinge, soos dié deur laers en elastiese koppelingse veroorsaak. Inmiddels is twee instrument-panele gebou en met al die nodige kontroles en meet-instrumente toegerus.

The storage tank and butterfly valve, as well as the required air filters and an aftercooler, have been ordered. Tenders have been received for a suitable air drying system, and a heat exchanger for the maintenance of constant temperature in the working section is at present being designed. The aerodynamic design of the contraction and supersonic nozzles is completed and working drawings of these components are being prepared in the Institute's Design Office.

#### **Air Entrainment in Air Jets**

In the operation of several types of aerodynamic machine an air jet is utilized for setting large masses of air in motion. An experimental jet pump designed for the induction of air flow in the smaller pneumatic conveyor plant, was carefully tested and a comprehensive jet pump theory evolved on the basis of the experimental results. This theory serves as a guide for jet pump design, and was used in the development of the larger pump for new closed-circuit conveyor. This larger pump was also constructed as an experimental unit, with a view to extending the jet pump theory.

#### **Air Flow Resistance of Gauze Screens**

Gauze screens are commonly used in order to improve the quality of flow in windtunnels and in other aerodynamic apparatus.

A method was evolved by which the aerodynamic resistance of gauze materials can be determined quickly and accurately with the aid of a sensitive drag balance. The new technique yields dependable results down to the smallest speeds that can be measured with accuracy.

#### **Other Investigations and Services**

Twelve aerodynamic measuring instruments, including manometers, pitot tubes, rotameters and hot-wire anemometers, were calibrated on behalf of outside firms and other C.S.I.R. Laboratories.

### **AERODYNAMIC MACHINES**

#### **Fan Noise**

The fan noise test rig to be used for the purposes of an investigation aimed at reducing fan noise at its source, was put into successful operation, and a start was made with the experimental programme.

After erecting the test rig, it first became necessary to solve several serious problems connected with extraneous vibrations such as those caused by bearings and flexible couplings. At this stage two consoles were built and fitted with all the controls and measuring instruments required.



Voorlopige werk wat uitgevoer is, het die volgende behels: die waaierrotor van 30 duim deursnee met dryfas, is op akkurate wyse dinamies gebalanseer; die afgeskernde mikrofoon, met sy bykomstige elektroniese apparaat, is opnuut geëyk; die waaierprestasie is bepaal; en ten slotte is die bedryfstoestande van die apparaat geëyk met betrekking tot statiese drukings, soos by vasgestelde meetpunte bepaal.

#### Navorsing op Lemroosters

In 'n gevordere stadium van die ontwerp van die lemroosterwindtunnel het dit geblyk dat die tunnel buitensporig duur sou wees. Aandag is gevolglik geskenk aan die ontwerp van 'n roostertunnel waarvan die toetsruim aan die inlaatkant in plaas van aan die uitlaatkant, volgens normale gebruik, aangebring word. Alhoewel hierdie tipe tunnel nie onderhewig is aan die nadeel van hoë kragverbruik as gevolg van kinetiese energieverliese by die uitlaat nie, bied dit egter moeilikhede wat konstruksie en instrumentasie betref.

'n Nuwe voorlopige ontwerp is voltooi, maar aangesien dit verskeie nuwe begrippe van konstruksie en instrumentasie behels, is daar besluit om eers 'n model te bou en vir voorlopige ontwikkelingswerk te gebruik. 'n Geskikte model is vervaardig en op so 'n wyse opgerig dat die 24-duim-metaalwindtunnel deel van die samestelling uitmaak. Goeie vordering is reeds met die eksperimentele werk gemaak.

Teoretiese ontledings van verskillende lemroosters het ook gevorder en 'n nuwe benaderde teorie is ontwikkel waarvolgens die tyd verbonde aan die berekening van roostereienskappe met ongeveer vier-vyftes verminder word.

#### Werkverrigting van Windmeulens

Vier windmeulens met deursnee wat tussen 8 vt. en 14 vt. wissel is op kontrak getoets. Soos in die verlede is die meulens aangebring op die bak van 'n vragmotor wat dan telkens teen 'n konstante spoed voortbeweeg kon word om die verlangde windsnelhede te verkry. Die grootte van die meulens het ons egter genoodsaak om 'n groter samestel en 'n swaarder vragmotor as in die verlede te gebruik.

Hierdie toename in grootte het twyfel laat ontstaan in verband met maonlike sturings weens lugdefleksie voor die meule, en daar is gevolglik besluit om eers 'n ondersoek in hierdie verband in te stel. 'n Skaalmodel van die vragmotor met meule is gebou, en in die 10-vt. windtunnel getoets. Die resultate het getoon dat sowel skaal- as sturingsinvloede onbeduidend klein was.

Die windtonneltoetse het nie alleen die inligting verstrekkend op onmiddellik nodig was nie, maar as aanvoerkedien ter ontwikkeling van 'n voorgestelde tegniek waarvolgens die werkverrigting van windmeulens in die algemeen met behulp van skaalmodelle bepaal sal kan word.

Preliminary work involved the accurate dynamic balancing of the 30-in. diameter fan rotor and its shafts, the recalibration of the shielded microphone in conjunction with its associated electronic equipment, determination of the fan performance and calibration of test rig operating conditions in terms of static pressures measured at selected stations.

#### Cascade Research

At an advanced stage of the design of the cascade windtunnel it appeared that the cost of the tunnel would be prohibitive. Consideration was, therefore, given to the design of a tunnel which has its working section at the inlet side instead of at the outlet side, as is more usual. Although this type of tunnel does not suffer from the disadvantage of high power requirement due to large kinetic energy losses at the outlet, there are on the other hand, difficulties associated with its construction and instrumentation.

A new preliminary design was completed, but since several features of construction and instrumentation were of novel conception, it was decided to build a scale model of the tunnel first, and to use it for the purposes of preliminary development work. A suitable model was built, and erected in such a way that the 24-in. metal windtunnel forms part of the arrangement. Good progress was made with the experimental work.

Progress was also made with theoretical analyses of different cascades, and a new approximate theory was developed which can reduce by about four-fifths the time required to calculate the characteristics of a cascade.

#### Windmill Performance

Four windmills, varying in size between 8 and 14 ft. diameter were tested under contract. As in previous tests each windmill was mounted on the back of a truck which was driven at constant speeds to provide the uniform wind velocities required. The size of the mills, however, necessitated the use of a larger installation and a bigger truck had to be used.

This increase in size caused some doubt regarding possible interference effects due to deflection of the air ahead of the windmill, so it was decided first to investigate these effects. For this purpose a scale model of the truck with windmill was constructed and tested in the 10-ft. windtunnel. Results indicated that both scale and interference effects were negligible.

These windtunnel tests, apart from yielding the information immediately required, can be considered to have paved the way towards the possibility of determining windmill performance by means of scale model tests.



### Ontwerp van Omhulde Waaiers

As gevolg van 'n teoretiese ondersoek, is daar besluit om 'n waaier met 'n enkele rotor, en toegerus met sowel inlaat- as uitlaatilemme, te ontwerp vir 'n beplande windtonnel met 6 vt. deursnee en geslote kringloop. Die ontwerp van 'n geskikte waaier en van 'n skaalmodel wat vir die voorlopige ontwikkelingswerk gebruik sal word, is vervolgens voltooi.

Veredere werk was daarop gemik om die nuwe waaier-ontwerpsteorie uit te brei om, in plaas van kanaalverliese saam te snoer op grond van die sogenaamde „kanaal-benuttigingsgraad”, die individuele verliese in die leimeme en diffusor en verliese as gevolg van sekondêre strominge, deur gebruikmaking van 'n aantal empiriese konstantes in te skakel.

Eksperimentele werk is in hierdie verband in die 24-duim-windtonnel uitgevoer, wat 'n studie vereis het van die lugvloei deur 'n stel tipiese leimeme, in 'n omhulsel van 12-duim buitedeursnee gemonter. Werk van soortgelyke aard, gesteun deur teoretiese studies, duur voort.

### Swigting van Hoeklemme

Die ondersoek wat namens 'n myngroep onderneem is om die oorsaak te bepaal vir die swigting van een van die hoeklemme in 'n stel binne-in die inlaatpyp van 'n turbo-kompressoreenheid, is met welslae voltooi.

Die resultate van die ondersoek, wat uitgevoer is op 'n skaalmodel van die installasie, het getoon dat 'n vleuelklep stroomop van die hoeklemme in sekere toestande daartoe kon gelei het dat 'n sterk en gevaarlike straal turbulente lug die lem wat geswig het, kon tref. Die opdraggewers het later beaam dat die volskaalse klep in die „verkeerde” draairigting gewerk het, en dat bedryfs-toestande, wat die swigting voorafgegaan het, inderdaad grotendeels beperk was tot 'n gebied wat in diemodeltoets as krities bestempel kon word.

### Lugdinamiese Filters

'n Ernstige probleem waarvoor die onderafdeling Termodinamika te staan kom, is om as te verwyder uit die gasse wat deur die lemme van steenkoolgasturbines vloei. Gevolglik is 'n begin gemaak met 'n ondersoek met die oog op die ontwerp en ontwikkeling van geskikte filtreereenhede.

Alle bestaande tipes lugfilter word tans nagegaan, en aandag word veral geskenk aan sikloonasskeiers en eenhede waarvan die werking afhanklik is van sekondêre lugvloei en grenslae wat in roterende lemwiele ontstaan.

'n Sistematiese teoretiese en eksperimentele navorsings-program word beplan.

## HIDROMEGANIKA

### Voorsiening van basiese Laboratoriumbenodigdhede

Die ontwerp van basiese laboratoriumtoerusting word voortgesit. Bestellings is geplaas vir die belangrikste

### Design of Ducted Fans

As the result of a theoretical investigation, it was decided to design a single stage fan, having both inlet guide vanes and outlet straightener vanes, for the proposed new 6 ft. diameter, closed-circuit windtunnel. The design of a suitable fan, and of a scale model which will be used for preliminary testing and development work, was subsequently completed.

Further work was aimed at extending the new fan design theory in such a way that, instead of combining all annulus losses in terms of the so-called annulus efficiency, the individual losses such as those due to guide vanes, diffuser and secondary flows, may be introduced by means of a number of empirical constants.

Some experimental work was done which involved a study of the flow in a set of typical guide vanes mounted in an annulus of 12-in. outside diameter and coupled to the 24-in. windtunnel. This work, supported by theoretical investigations, is still under way.

### Corner Vane Failure

An investigation undertaken on behalf of a mining group, and aimed at determining the cause of failure of corner vanes installed in the intake duct of a turbo-compressor plant, was satisfactorily completed.

The results of the investigation, which was conducted on a scale model of the arrangement, indicated that a butterfly valve upstream of the corner vanes could, under certain circumstances, have caused a powerful and dangerous jet of turbulent air to impinge on the particular vane that was fractured. The sponsors subsequently confirmed that the full-scale valve had been working the “wrong” way and, indeed, that operation prior to failure had been mainly confined to conditions now known to have been within a critical region.

### Aerodynamic Filters

A serious problem confronting the Thermodynamics Section is that of separating ash from the hot gases before passing through the blades of coal-fired gas turbine. A start was, therefore, made on an investigation aimed at designing and developing suitable filter units.

A survey of all existing types of air filters is at present being conducted, special attention being devoted to cyclone separators, and to devices which depend for their action upon the secondary flows and boundary layers set up in rotating impellers.

A systematic theoretical and experimental research programme is being planned.

## HYDROMECHANICS

### Provision of Basic Laboratory Equipment

The design of basic laboratory equipment was continued. Orders have been placed for the major equipment



toerusting vir die oprigting van 'n volumetriese vloeikring en van 'n oop waterkanaal met die oog op groter navorsingsmoontlikhede.

Verseke meetinstrumente soos manometers, rotor-spoedmeters en 'n vloeistof-hoogtemeter van die naald-tipe, is oorsee bestel. Verder word 'n akkurate meerbuisige manometer en 'n meter vir lae watervloeiensnelhede met onbeduidende drukverlies in die laboratorium gebou.

#### **Vloei van vloeistowwe in 'n Spiraalpylp**

'n Eksperimentele ondersoek is geloods om die uitwerking van pypkromming op die drukverlies van vloeistowwe wat deur 'n spiraalpylp vloei, vas te stel. Uitbreiding van die omvang van die toetse moes uitgestel word in afwagting van die oprigting van 'n meerbuisige manometer.

#### **Kavitاسie**

Navorsing in verband met die verskynsel van kavitاسie word tans beplan. 'n Klein kavitاسietunnel is ontwerp, en vir die vervaardiging daarvan is reeds 'n bestelling geplaas. Die toetsruim van die tunnel, vir watersnelhede tot 90 myl per uur, is alreeds deur die Sentrale Werkplaas voltooi.

#### **Laboratorium vir Viskose Strooming en Servo-beheer**

Met die oog op toekomstige behoeftes is 'n begin gemaak met die ontwerp van basiese benodighede vir navorsing in verband met viskose strooming en vir die ondersoek van probleme op die gebied van servo-beheer.

#### **Hersirkulasie van Mynwater**

'n Toets met 40 ton natriumchloried as spoorvormer, wat gedurende die afgelope jaar uitgevoer is om te bepaal of die mynwater wat deur 'n groep myne in die Wes-Witwatersrand uitgepomp word, hersirkuleer, is opgevolg deur 'n verdere toets waarin gebruik gemaak is van fluoreseen-kleurstof as spoorvormer. Die resultate van hierdie fluoreseentoets het die bevindings van toetse met sout bevestig, nl. dat 'n gedeelte van die water wat deur die myne uitgepomp word, in die myne terugvloei en weer uitgepomp moet word. Die toetse word voortgesit.

#### **Erosie van Rivierbeddings**

As voorbereiding vir moontlike uitgebreide ondersoeke van die erosie van Suid-Afrikaanse riviere word 'n opname van die vernaamste prosesse wat aan erosie verbonde is, gemaak. Met hierdie taak is onlangs eers 'n begin gemaak, en dit word voortgesit. Daar word beplan om die ondersoek verder uit te brei na oseaan-erosie sowel as die verskynsel van toeslikking.

#### **Hidrouliese Analog vir 'n Verbrandingsresonator**

Ter bystand met die ontwikkeling van 'n verbrandingsresonator deur die Afdeling Termodinamika van die

for a water flow-measuring circuit, and for an open water flume to enable the undertaking of a much wider range of investigations.

Several items of measuring equipment such as manometers, propeller meters and needle gauges were ordered overseas, and in addition, an accurate multi-tube manometer and a meter for measuring low water flow rates with negligible pressure loss, are being built in the laboratory.

#### **Flow of Liquids in Coiled Pipes**

An experimental investigation was initiated to determine the effect of pipe curvature on the pressure loss of flowing fluids. Extension of the range of the tests had to be suspended pending construction of a suitable multi-tube manometer.

#### **Cavitation**

Research into the phenomenon of cavitation was initiated. A small cavitation tunnel was designed, and an order has been placed for its manufacture. The working section of the tunnel, in which water speeds up to 90 m.p.h. may be attained, has already been completed by the Workshops.

#### **Viscous Fluids and Servo-control Laboratory**

In anticipation of future demands a start has been made on the design of basic facilities for viscous fluid research, and for investigation of hydraulic servo-control problems.

#### **Mine Water Recirculation**

The 40-ton sodium chloride tracer test conducted during the past year to determine whether mine water pumped by a group of mines in the West Witwatersrand is recirculating, was followed by a further test using one ton of fluorescein dye as the tracer. The results of the fluorescein test substantiated the conclusions of the salt test, namely that a portion of the water from the mines does flow back into them and must therefore be pumped. The tests are continuing.

#### **Erosion of River Beds**

As a preliminary to possible extensive investigations into the erosion of South Africa's rivers, a survey is being made of the fundamental processes involved in erosion. This work started only recently and is proceeding. It is planned to extend the scope of the investigations to include ocean erosion as well as siltation phenomena.

#### **Hydraulic Analog to a Combustion Resonator**

To aid in the development of a combustion resonator by the Thermodynamics Section, an hydraulic ana-



Instituut, is 'n hidrouliese analoog gebou waarin oppervlaktegolwe in water as ekwivalent vir klankgolwe in die resonator sal dien. Die werk word nog voortgesit.

#### **Ander Ondersoeke**

Behalwe bogenoemde take, is navrae ontvang en afgehandel oor uiteenlopende onderwerpe soos aanhoudende vermenging van vloeiende vloeistowwe, die beheer van grenslae op seilbootrompe, die toets van 'n hidrouliese servo-beheerklep, die yking van twee vloeimeters en die vermenging van smeerolies.

log is being constructed in which surface waves in water will serve as the equivalent of acoustic waves in the resonator. The work is still in progress.

#### **Miscellaneous Investigations**

In addition to the work described above, enquiries involving such diverse subjects as the continuous mixing of flowing fluids, the control of the boundary-layer on sailboat hulls, the testing of an hydraulic servo-control valve, the calibration of two current meters and the blending of lubricating oils were handled.

# Nasionale Telekommunikasie- navorsingslaboratorium

*Direkteur: DR. F. J. HEWITT*

Die studie van radiogolfvoortplanting deur die onderste en boonste luglae is as 'n belangrike deel van die laboratorium se program voortgesit. Met die oog op die wêreldprogram vir intensiewe waarnemings gedurende die Internasionale Geofisiese Jaar, het sekere aspekte besondere aandag geniet.

Werk is voorgesit in verband met die ontwikkeling van toerusting om te voldoen aan spesiale vereistes wat by die produksie van toerusting van dié aard in Suid-Afrika ontstaan het. In die Verenigde Koninkryk is demonstrasies en toetse uitgevoer in verband met toerusting vir vermeting vir landmeetdoeleindes (volgens 'n ontwerp in die laboratorium ontwikkel en wat tans in Suid-Afrika vervaardig word) en hulle het goed afgegaan. Die toetse dien waarskynlik as die akkuraatste bepaling van die snelheid van radiogolwe deur die atmosfeer van die aarde wat tot nog toe gedoen is. Die toerusting wat in Kaapstad deur 'n Suid-Afrikaanse maatskappy vervaardig word, word tans dwarsdeur die wêreld verkoop. Heelwat werk is bestee aan die waarneming op sy baan van die eerste kunstmaan wat in Oktober deur die Russe gelanseer is. Geïmproviseerde toerusting is gebruik en die akkuraatheid van die resultate was betreklik laag. Die installering van 'n Amerikaanse waarnemingstasie vir die radiowaarneming van kunstsatelliete nader voltooiing.

Soos in die verlede is die laboratorium gehuisves op 'n perseel wat die Universiteit van die Witwatersrand beskikbaar gestel het. Veldwerk is uitgevoer op die universiteit se proefplaas te Frankenwald, by die Jan Smuts-lughawe, by die Suid-Afrikaanse Uitsaaikorporasie se ontvangstasie, Panorama, die Opleidingskollege van die Spoorweë te Esselenpark en die Ontvangstasie van die Poskantoor te Derdepoort. Ionosferiese waarnemings word namens die laboratorium deur die Suid-Afrikaanse Departement van Pos-en-Telgraafwese te Kaapstad en deur die Suid-Afrikaanse Weerburo te Marioneiland gedoen. Die Raad wil sy waardering van hierdie diensgeriewe aan die betrokke organisasies uitspreek.

'n Permanente gebou vir die laboratorium word tans op die terrein van die Universiteit van die Witwatersrand gebou.

## DIE VOORTPLANTING VAN RADIOGOLWE

### Ionosferiese Waarnemings en Voorspellings

Die gereelde bepaling van ionosferiese eienskappe wat by die voorspelling van toestande vir radioverbindinge

# National Telecommunications Research Laboratory

*Director: DR. F. J. HEWITT*

The study of the propagation of radio waves through the lower and upper atmosphere has continued as an important part of the programme of the laboratory. Particular attention has been paid to certain aspects, in view of the world programme for intensive observations during the International Geophysical Year.

Work has continued on the development of equipment to meet special requirements that have arisen in South Africa and with the problems encountered in the commercial production of such equipment in South Africa. Demonstrations and tests of distance measuring equipment for survey purposes (the latter based on a design developed in the laboratory and now manufactured in South Africa), were conducted in the United Kingdom and were completely satisfactory. The tests constitute probably the most accurate determination of the velocity of radio waves through the earth's atmosphere yet made. The equipment, manufactured in Cape Town by a South African Company, is now being sold throughout the world.

Considerable effort was devoted to the radio tracking of the first artificial satellite, launched by the Russians during October. Improvised equipment was used and the accuracy was relatively low. Installation of an American artificial satellite radio tracking station of high accuracy is nearing completion.

As in the past, the laboratory has been housed in premises made available by the University of the Witwatersrand, Johannesburg. Field work has been conducted at the University Experimental Farm at Frankenwald, at Jan Smuts Airport, at the Panorama receiving station of the S.A. Broadcasting Corporation, at the Railway Training College at Esselen Park, and the Post Office Receiving Station at Derdepoort. Ionospheric observations are made at Cape Town on behalf of the laboratory by the South African Department of Posts and Telegraphs and at Marion Island by the South African Weather Bureau. The Council wishes to express to the organizations concerned its appreciation of these facilities.

A permanent building for the laboratory is now under construction in the grounds of the University of the Witwatersrand.

## THE PROPAGATION OF RADIO WAVES

### Ionospheric Observations and Forecasts

The regular measurements of ionospheric characteristics, necessary for the forecasting of radio communica-



nodig is, is voortgesit. Op Marioneilend is 'n stasie met behulp van die Weerburo opgerig, met die oog op die belangrikheid van ionosferiese waarnemings vir hierdie omgewing tydens die Internasionale Geofisiese Jaar. In moeilike werkomstandighede was die uitslae van hierdie stasie af nie volkome bevredigend nie, maar heelwat nuttige inligtings word tog verkry. Die stasie te Nairobi is afgeskaf en die toerusting is aan die Universiteit van die Federasie van die Rhodesië en Njassaland te Salisbury geleen, waar dit in verband met ander proefnemings tussen Johannesburg en Salisbury aangewend word.

Die opstel en uitgee van maandelikse voorspellings van optimum frekwensies vir gebruik oor roetes in Suidelike Afrika is voortgesit.

### **Ionosferiese Onderzoek**

Weereens is die werk op die onderste streke van die ionosfeer gekonsentreer, d.w.s. op die streke wat groterdeels vir die absorpsie van radiogolwe van hoë frekwensie verantwoordelik is. Die absorpsie wat onder 'n vertikale invalshoek ondervind word, is gereeld op twee verskillende frekwensies bepaal en tegelykertyd is verdere besonderhede in verband met die onderste streke van die ionosfeer deur waarneming van gedeeltelike weerkaatsings en deur proefneming met impulsruismodulasie verkry. Impulstransmissie, onder 'n skuinse hoek, tussen Johannesburg en Salisbury is ook vasgestel. Verder is snelhede van ionosferiese dryfstromings gereeld bepaal.

Hierdie ondersoek maak deel uit van die Suid-Afrikaanse program wat deur die Suid-Afrikaanse Nasionale Komitee vir die Internasionale Geofisiese Jaar beplan is.

### **Peile van Radiogeruis**

Die studie van die algemene vraagstuk van radiogeruis en die uitwerking daarvan op radiokommunikasiestelsels is onderbreek, omdat dit nodig was om aandag te bestee aan die waarneming van kunsmatige aardsatelliete. Nietemin was dit moontlik om met behulp van die Suid-Afrikaanse Poskantoor 'n veelgolfruisregistreerder deur die Central Radio Propagation Laboratory van die Verenigde State se Standaardburo verskaf, te installeer en daarvoor toesig te hou. Hierdie registreerder sal baie nodige inligtings oor ruispeile wat op die hoëfrekwensieband in Suid-Afrika ondervind word, verstrek.

### **Kristalbeheer met Veranderlike Frekwensie**

Die produksie word voortgesit van kommunikasie-ontvangers van Racal Engineering, die firma van die Verenigde Koninkryk wat kragtens 'n lisensie van die W.N.N.R. ontvangers vervaardig en verkoop, waarin kristalbeheer volgens die „Wadley-stelsel” met veranderlike frekwensie gebruik word.

### **Die „Tellurometer”-metode van Afstandmeting**

In April 1957 is 'n demonstrasie van die tellurometer-metode voor die hoofde van die verskillende opname-

tions conditions, have continued. A station was established at Marion Island with the assistance of the Weather Bureau, in view of the importance of ionospheric observations for this locality during the International Geophysical Year. Under the difficult conditions of operation the results from this station have not been altogether satisfactory but some useful information is being obtained. The station at Nairobi has been withdrawn and the equipment loaned to the University of the Federation of the Rhodesias and Nyasaland, at Salisbury where it is used in conjunction with other experiments conducted between Johannesburg and Salisbury.

The preparation and issue of monthly forecasts of optimum frequencies for use over circuits in Southern Africa have continued.

### **Ionospheric Investigations**

Work was again concentrated on the lower regions of the ionosphere, the regions responsible in the main for the absorption of high frequency radio waves. The absorption experienced at vertical incidence was measured regularly on two different frequencies and more detailed information on the lower regions of the ionosphere was obtained at the same time by the observation of partial reflections and by a pulse cross-modulation experiment. Oblique incidence pulse transmissions between Johannesburg and Salisbury were also established. Ionospheric drift velocities were also measured regularly.

These investigations form a part of the South African programme planned by the South African National Committee for the International Geophysical Year.

### **Radio Noise Levels**

The study of the general problem of radio noise and its effect on radio communication systems was interrupted by the need to direct effort to the tracking of artificial earth satellites. It was nevertheless possible to undertake, with the assistance of the South African Post Office, the installation and supervision of an all-wave noise recorder supplied by the Central Radio Propagation Laboratory of the United States Bureau of Standards. This recorder will provide much-needed information on noise levels experienced in South Africa on the high frequency band.

### **Variable Frequency Crystal Control**

The production of communications receivers by Racal Engineering, the United Kingdom firm licensed by C.S.I.R. to manufacture and sell receivers using the “Wadley” system of variable frequency crystal control, continues.

### **The “Tellurometer” System of Distance Measurement**

The “Tellurometer” system was demonstrated to the heads of the various survey organizations in Great Britain



organisasies in Groot Brittanje gebou. 'n Program van opmetings is aan die geodetiese basis, Ridgeway, in die suide van Engeland uitgevoer en die instrument het met goeie gevolg tydens die beheerde toetse onder toesig van die United Kingdom Ordnance Survey aan sy spesifikasie voldoen. Daarbenewens is lesings en demonstrasies voor talle organisasies en individue waaronder die Royal Geographical Society, Londen, en die Internasionale Hidrografiese Vereniging in Monaco, gehou.

'n Akkurate bepaling van die snelheid van radiogolwe is deur middel van uitgebreide opmetings van die Ridgeway-basis en sy driehoeksomgewing gedoen om 'n waarde te verkry wat voortaan met volle vertroue by praktiese tellurometerwerk gebruik kan word. Die verkreeë waarde is 299792.5 Km/s, wat feitlik presies klop met die bepaling wat onlangs volgens laboratoriummetodes deur die Britse Nasionale Fisiese Laboratorium gedoen is.

Dwarsdeur die onderhawige tydperk is die produksie van die instrument deur Tellurometer (Pty.) Ltd., in samewerking met die W.N.N.R. voortgesit. Die instrumente wat in Kaapstad vervaardig is, is dwarsdeur die wêreld verkoop en baie van hulle word tans in die Verenigde State, op die Europese Vasteland, in Australasië, Kanada en die Midde-Ooste gebruik. Ander is na Japan, Indië, Suidoos-Asië, Venezuela en ander Suid-Amerikaanse lande uitgevoer.

Die tellurometerinstrument is hoofsaaklik vir geodetiese opname ontwerp. Sy veelsydigheid, vervoerbaarheid en eenvoud, buiten en behalwe sy akkuraatheid, het tot die gebruik daarvan vir allerlei ander doeleindes gelei. In die Verenigde State word hy in die ontsaglike werkprogram vir tussenstaatse hoofweë gebruik en in Kanada het die aanwending daarvan, met behulp van helikoptervervoer, uitgebreide roetebepalings van meer as 100 myl per dag moontlik gemaak. Ook by opnames vir die leër, siviele ingenieurswerk, geofisiese opnames en as middel tot skaalkontroliering by fotografiese opnames het die gebruik daarvan nuttig geblyk.

#### **Stellingbepaling**

Namens die Unie-verdedigingsmag is die probleem van die bepaling van stellings deur grondtroepe ingeneem, met behulp van ligte presisie-instrumente bepaal. Moontlike stelsels is ontleed en die relatiewe voordele deur beperkte proefnemings vasgestel. 'n Stelsel is uitgewerk wat moontlik aan die vereistes kan voldoen en met die oog op proewe om die moontlikhede daarvan te bepaal, is 'n praktiese ontwerp reeds aangepak.

#### **Weerligstudies met Behulp van Radar**

In die somerseisoen is 'n beperkte reeks waarnemings van radareggo's van weerlig verkry. Hulle word bestudeer. Talle tegniese probleme het opgeduik en verdere ontwikkelingswerk is nodig voordat hierdie studie bevredigend afgehandel kan word.

in April, 1957. A programme of measurements was carried out at the Ridgeway geodetic base in the South of England and the instrument successfully met its specification under controlled tests supervised by the United Kingdom Ordnance Survey. In addition, lectures and demonstrations were given to numerous organizations and individuals including the Royal Geographical Society in London and the International Hydrographic Society in Monaco.

An accurate determination of the velocity of radio waves was made by means of extensive measurements of the Ridgeway base and surrounding triangulation, for the purpose of obtaining a value which may be confidently used in future practical "Tellurometer" work. The value arrived at was 299792.5 Km/s which is in almost precise agreement with recent determinations made at the British National Physical Laboratory by laboratory methods.

Production of the instrument by Tellurometer (Pty.) Ltd., in association with the C.S.I.R. has continued. The instruments manufactured in Cape Town have been sold throughout the world, many now being in use in the United States, the Continent of Europe, Australasia, Canada, and the Middle East. Others have been exported to Japan, India, South East Asia, Venezuela and other South American countries.

The primary purpose for which the "Tellurometer" instrument was designed was for geodetic survey. Its versatility, portability and simplicity, despite its very high accuracy, has resulted in its use for various other purposes. In the United States it is being used in the vast inter-state highway programme and in Canada, using helicopter transport, extended traverses of over 100 miles per day have been made possible by its use. It has also found its uses in army survey, civil engineering, geophysical survey and as a means of scale control in photographic survey.

#### **Position Fixing**

An investigation into the problems of fixing the position of military ground forces by means of lightweight high precision instruments was undertaken on behalf of the Union Defence Force. Possible systems were analysed and relative merits assessed by means of limited experiments. A system was devised which might meet the requirements and a practical design was commenced with a view to testing its possibilities.

#### **Lightning Studies by Radar**

During the summer season a limited series of observations of radar echoes from lightning were obtained. These are being studied. Many technical problems were encountered and further development work will be necessary before this study can be satisfactorily completed.



### **Radiowaarneming van Kunssatelliete**

Op versoek van die Suid-Afrikaanse Nasionale Komitee vir die Internasionale Geofisiese Jaar het die laboratorium dit op hom geneem om 'n akkurate radiowaarnemingstelsel, die sogenaamde „Minitrack” in Suid-Afrika te installeer en aan die gang te hou. Hierdie toerusting is deur die Verenigde State se Naval Research Laboratory as deel van sy projek Vanguard ontwikkel. Die stelsel is uiters sekuur en kan die baan van 'n satelliet wat van 'n geskikte radiosender voorsien is, byna so akkuraat as optiese waarnemingsmetodes vasstel, terwyl daar geen beperkings ten opsigte van die weer of dagbreek- en skemertoestande aan verbonde is nie.

Hierdie toerusting is in die onderhawige tydperk met behulp van verskillende organisasies met welslae geïnstalleer. As terrein is die S.A. Spoorweë en Hawens se Opleidingskollege te Esselenpark naby Johannesburg gekies. Tydens die onderhandelings oor reëlins in verband met die Minitrack is die eerste Russiese kunssatelliet reeds, sonder bepaalde voorafgaande waarskuwing, met sukses op sy baan gebring. Die laboratorium het onmiddellik 'n radiowaarnemingstelsel gepraakseer, wat betreklik onnoukeurig was, maar het binne 'n paar dae die baan naasteby bepaal. Die waarnemings is voortgesit totdat die satelliet se radiosender geswig het. Teen dié tyd was die baan reeds taamlik noukeurig vasgestel en kon sekere feite omtrent bolugtoestande afgelei word.

### **VERDEDIGINGSNAVORSING**

Die laboratorium het verskeie stukke radartoerusting wat plaaslike gemaak is, getoets en hulle bevredigend bevind. Sekere meganiese veranderings het nodig geblyk en hulle is uitgevoer. 'n Noukeurige studie is gemaak van allerlei aspekte van die prestasies van die proefmodel wat die laboratorium self gebou het, met die oog op die maksimum doeltreffendheid van sy werkverrigting. Die probleem van die waarneming van seine tydens lawaai het veral aandag geniet.

'n Begin is gemaak met die studie van die uitwerking van reënreggo's op die prestasie van radarstelle wat op verskillende frekwensies werk.

Die huidige toestand in die buiteland, wat radar en die beheer oor beheerde projektiële betref, is oorsee in samewerking met die Departement van Verdediging bestudeer.

### **Radio Tracking of Artificial Earth Satellites**

At the request of the South African National Committee for the International Geophysical Year, the Laboratory accepted responsibility for the installation and operation in South Africa of a precise radio tracking system known as "Minitrack". This equipment was developed by the United States Naval Research Laboratory as part of the project "Vanguard". It is a system of extreme accuracy and is capable of determining the course of a satellite equipped with a suitable radio transmitter to an accuracy approaching that of optical methods, though not restricted by weather conditions or to dawn and dusk conditions.

The installation of this equipment was effectively completed during the period under review with the assistance of a number of different organizations. The site selected was the South African Railways and Harbours Training College at Esselen Park near Johannesburg. While the arrangements for "Minitrack" were being negotiated the first Russian artificial satellite was successfully established without specific advanced warning. A relatively inaccurate radio tracking system was immediately improvised and within a few days the orbit was roughly determined. The observations continued until the failure of the satellite's radio transmitter, by which time the orbit had been determined with considerable accuracy and certain facts deduced about conditions in the upper atmosphere.

### **DEFENCE RESEARCH**

Various items of radar equipment manufactured locally have been tested by the laboratory and found satisfactory. Some mechanical modifications were found to be necessary and were carried out successfully. A detailed study has been conducted of various aspects of the performance of the laboratory-built pilot model with a view to ensuring the maximum efficiency of operation. Particular attention was given to the problem of the detection of signals in the presence of noise.

A study was commenced of the effect of rain echoes on the performance of radar sets operating on various frequencies.

A study was carried out overseas of the current situation regarding radar and the control of guided weapons in collaboration with the Department of Defence.



# Nasionale Bounavorsingsinstituut

*Direkteur:* MNR. N. STUTTERHEIM

Navorsing gedoen aan die Instituut ten opsigte van die probleme by die ontwerp van geboue om by die klimaat te pas, het steeds vordering gemaak. 'n Meer intensiewe poging is aangewend met die voorbereiding en aanbieding van klimatologiese gegewens met betrekking tot warmte, ventilasie en natuurlike verligtingstoestande vir die doeleindes van geboue-ontwerp, en die resultate word in toenemende mate toegepas. Die groter vraag om die sonkaarte wat deur die Instituut uitgegee is vir gebruik vir sonlig-en-skaduwee-ontwerpe vir geboue in Suidelike Afrika, is 'n goeie voorbeeld. Verder het die oorsese organisasies wat hul op tropiese bouwetenskap toelê, te kenne gegee dat hulle besig is om soortgelyke sonkaarte vir ander dele van Afrika waarin hulle besonder geïnteresseerd is, voor te berei.

Die Direkteur het die Unie verteenwoordig by die derde vergadering van die Inter-Afrikaanse Behuiskomitee van die Kommissie vir Tegniese Samewerking in Afrika besuide die Sahara (C.C.T.A.) wat gedurende Desember 1957 in Londen gehou is. Hy het ook die voorlopige vergadering van deskundiges bygewoon wat deur die C.C.T.A. saamgeroep is om 'n program op te stel vir die Tweede Inter-Afrikaanse Konferensie oor Behuising en Verstedeliking wat gedurende Januarie 1959 in Nairobi gehou sal word. Hierdie konferensie is gesamentlik georganiseer deur die C.C.T.A. se Komitees vir Behuising en Sosiale Wetenskappe. Sy doel is om inligting uit te ruil wat deur navorsings en ondervinding verkry is en wat van praktiese waarde kan wees by die oplossing van behuising- en stadsbeplanningsvraagstukke en verwante sosiale probleme in die verskillende gebiede in Afrika.

As deel van die hospitaalnavorsingsprogram is 'n polikliniek deur die Instituut ontwerp en in Meadowlands naby Johannesburg gebou, en dit is teen die einde van 1957 in werking gestel. 'n Voorlopige statistiese ontleding van die verslae toon aan dat die mediese dienste wat beskikbaar gestel is, 'n daling teweeggebring het in die aantal pasiënte van die Meadowlandsgemeenskap wat in die Baragwanathospitaal opgeneem is. As dit bewys word, beteken dit dat 'n allesomvattende polikliniese diens die koste van die mediese dienste wesenlik sou kon verminder omdat polikliniese dienste sowel ten opsigte van kapitaal- as onderhoudskoste baie goedkoper is as hospitale.

Aansoek om hulp, inligting en advies in verband met 'n groot verskeidenheid bouprobleme het gedurende die jaar, bestendig toegeneem. 'n Noemenswaardige ontwikkeling in hierdie opsig was die merkbare toename in die aantal versoeke om advies deur praktiserende argitekte

# National Building Research Institute

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Work at the Institute on problems of design to suit climate continued to progress. A more intensive effort was begun on the preparation and presentation of climatological data related to thermal, ventilation and natural lighting conditions for building design purposes and the results are finding increasing application. One example is the greater demand for the solar charts issued by the Institute for use in sunlight and shade design for buildings in Southern Africa. In addition, three overseas organizations concerned with tropical building science have indicated that they are preparing similar solar charts for other parts of Africa in which they are particularly interested.

The Director represented the Union at the third meeting of the Inter-African Housing Committee of the Commission for Technical Co-operation in Africa South of the Sahara (C.C.T.A.) which was held in London during December, 1957, and also attended the preliminary meeting of experts called by C.C.T.A. to draw up a programme for the Second Inter-African Conference on Housing and Urbanization to be held in Nairobi during January, 1959. This conference is being organized jointly by the C.C.T.A. Housing and Social Sciences Committees. Its object is to exchange information, gained by research and experience, which could be of practical value in solving housing, town planning and related social problems in the various territories in Africa.

As part of the hospitals research programme a polyclinic was designed by the Institute and built at Meadowlands, near Johannesburg, and put into operation towards the end of 1957. A preliminary statistical analysis of records shows that the medical services offered have brought about a reduction in the number of admissions at the Baragwanath Hospital from the Meadowlands community. If this proves valid, it implies that a comprehensive polyclinic service could reduce the costs of medical services materially, since polyclinic services are much cheaper in capital and running costs than hospitals.

Requests for assistance, information and advice covering a wide range of building problems increased during the year. A noteworthy development in this respect was the marked increase in the approaches made by practising architects and engineers, indicating wider application of research findings to every-day building practice. The keen interest taken in the work of the Institute by the Science Committee of the South African Institute for Architects and by other professional organizations no doubt assisted in this development.



en ingenieurs wat op 'n breër toepassing van navorsingsbevindings by die alledaagse boupraktyk dui. Die lewendige belangstelling wat die Wetenskaplike Komitee van die Suid-Afrikaanse Instituut van Argitekture en ander professionele organisasies in die werk van die Instituut getoon het, het sonder twyfel tot hierdie ontwikkeling bygedra.

Beurse, toekennings en kontrakte tot 'n beraamde waarde van £23,000 het deur die hande van die Instituut gegaan. Werk is op 78 kontrakte gedoen waarvan 50 gedurende die jaar uitbestee is. Soos in die verlede, maar in 'n groter mate, moes versoeke om werk of van die hand gewys word of na ander organisasies en raadgevers verwys word.

## ARGITEKTUUR

### Minimum-Huisplanne

Die prototipe goedkoop huise vir blankes deur die Instituut ontwerp en op Witbank opgerig, is deur verteenwoordigers van 'n aantal behuisings- en plaaslike owerhede besoek, en planne word tans voorberei vir behuisingskemas vir Witbank, Potchefstroom en Port Elizabeth waarby die grondbeginsels van die prototipe huise toegepas word.

Navorsingswerk om die probleme in verband met die ontwerp van ouetehuse en huise vir die Kleurlingbevolking van Suid-Afrika te dek, word beplan. Soos met al die vorige werk in verband met behuising, word hierdie navorsing ook deur die Nasionale Behuisingskommissie ondersteun.

### Skoolnavorsing

Die verslae van die Skoolgebouekomitee, wat in September 1953 deur die Departement van Onderwys van die Transvaalse Provinsiale Administrasie saamgestel is, gee 'n volledige beeld van die navorsingsbevindings tot datum. Die gepubliseerde verslae dek navorsing ten opsigte van skoolmeubels, ligging van skoolgeboue en beplanning van gradekamers, skoolsale en laerskoolgeboue. 'n Verslag oor die beplanning van klaskamers en spesiale kamers in hoërskole is reeds gepubliseer terwyl twee addisionele verslae, „Beplanning van Hoërskole” en „Kleur en die Kind” tans in voorbereiding is.

Die eksperimentele laerskool te Waterkloof gebou is in Januarie 1958 in gebruik geneem. Die koste vir die bou van hierdie skool was aansienlik laer as dié van skole wat onlangs in Transvaal gebou is en wat 'n gelyke aantal skoliere kan huisves.

Die verligting, ventilasie en warmtetoestande in die gebou is gemeet deur die Afdeling Funksionele Doeltreffendheid van die Instituut terwyl dié Afdeling in noue voeling met die personeel van die skool gebly het, om sodoende die doeltreffendheid van die gebou na ingebruikneming te toets. Gebaseer op sekere gevolgtrekkings

The Institute handled fellowships, grants and contracts to an estimated value of £23,000. Work was done on 78 contracts of which 50 were commissioned during the year. To a greater degree than in the past requests for work had to be turned down or referred to other organizations and to consultants.

## ARCHITECTURE

### Minimum House Plans

The prototype European low-cost houses designed by the Institute and erected at Witbank were visited by representatives of a number of housing and local authorities, and plans for housing schemes in Witbank, Potchefstroom and Port Elizabeth are being prepared, embodying the principles of the prototype houses.

Research work has been planned to cover the problems of designing homes for the aged and houses for the Coloured population of South Africa. As with all previous work on housing, this research is sponsored by the National Housing Commission.

### Schools Research

The reports of the Schools Buildings Committee set up in September, 1953, by the Department of Education of the Transvaal Provincial Administration, present a comprehensive picture of the research findings to date. The published reports cover research on school furniture, siting of school buildings and planning of grades rooms, school halls and primary school buildings. A report on planning of classrooms and special rooms in high schools has been published and two additional reports "Planning of High Schools" and "Colour and the Child" are being prepared.

The experimental primary school at Waterkloof was built and occupied in January, 1958. The cost of building this school was considerably lower than that of schools of similar capacity built recently in the Transvaal.

The lighting, ventilation and thermal conditions in the building were measured by the Functional Efficiency Division of the Institute, while in close contact with the staff of the school in order to check the efficiency of the building in use. Based on certain conclusions, proposals can now be made which may prove to be of additional economic importance in the design of future schools,



trekkings waartoe geraak is, kan nou voorstelle gemaak word wat van addisionele ekonomiese belang in die ontwerp van toekomstige skole mag wees, soos die beplanning van klaskamers aan beide kante van die gang in plaas van die huidige stelsel om die klaskamers slegs aan een kant van die gang te bou.

'n Eksperimentele hoërskool, Lyttletonhoërskool, is in ooreenstemming met die aanbevelings van die Skoolgebouekomitee ontwerp, nadat verskeie planne van bestaande hoërskole ontleed en sketse geteken is gebaseer op die waarnemings wat gemaak is. Hierdie ontleding het aangetoon dat met 'n gegewe onderwysoppervlakte die totale oppervlakte van die skoolgebou aanmerklik verminder kon word en baie ruimte wat nie regstreeks met die onderwys verband hou nie, soos gange, trappe, en kleedkamers, verminder of weggelaat kan word.

Hierdie eksperimentele skoolgebou beantwoord aan die beginsel van soepelheid wat so belangrik is vir hoërskoolgeboue wat elke jaar vir 'n groter verskeidenheid spesiale vakke voorsiening moet maak. Daar is drie basiese klaskamergrottes wat dus 'n maksimum verandering toelaat sonder dat dit nodig is om belangrike konstruksionele wysigings aan te bring wanneer byvoorbeeld 'n addisionele wetenskaplaboratorium of kunskamer benodig word. Sulke veranderings kan bewerkstellig word deur die byvoeging van meubels en in sommige gevalle ook deur addisionele loodgieterswerk. Met die oog op die begeerte om meer geleentehede aan hoërskoolkinders te bied, is 'n gimnasium vir liggamsopvoeding verskaf. Die skoolsaal bly dus vry vir samekomste en spraak- en dramakunsstudies.

Die Provinsiale Administrasie van Transvaal het 'n argitek gesekondeer om die Instituut te help met die opstel van dokumente vir die bou van hierdie eksperimentele skool.

Die navorsing ten opsigte van skoolgeboue is geldelik deur die Transvaalse Provinsiale Administrasie gesteun.

### Hospitaalgeboue

Die beampte aan die hoof van hierdie projek het in September 1957 'n konferensie oor die beplanning en ontwerp van hospitale in Genève bygewoon, wat georganiseer is deur die „International Hospitals Federation”, en die „International Union of Architects”.

'n Studie van die metings wat gedoen is van die afstande wat verpleegsters aflê in agtien sale, het aangetoon dat omtrent 50 persent van al die afstande afgelê is van bed tot bed, 30 persent tussen dienskamer en bed en 20 persent tussen dienskamers. Die dienskamereenheid moet dus so sentraal moontlik geleë wees. Die relatiewe belangrikheid van die vernaamste dienskamers het by elke tipe saal verskil, en in kraam- en pediatriese sale is daar gevind dat 'n verdubbeling van die waskamers 'n groot voordeel was. In kraamsale is daar gevind dat die verdeling van werk tussen saalverpleegster en „baba-verpleegster” 'n baie belangrike faktor was, terwyl daar in heelwat kinderkamers 'n groot besparing in die totale

soos die planning of classrooms on both sides of the corridor instead of the present system of having the classrooms on one side only.

An experimental high school, Lyttletonhoërskool, was designed in accordance with the recommendations of the School Buildings Committee after several plans of existing high schools had been analysed and sketches prepared from the observations made. This analytical work indicated that, with a given teaching area, the overall area of the school building could be considerably reduced, and much space which has no direct relation to teaching, such as corridors, staircases and cloakrooms, could be reduced or eliminated.

This experimental school building incorporates the principle of flexibility so essential in high school buildings which have to provide space for greater variations in special subjects each year. There are three basic sizes of classrooms thus allowing for a maximum of change without necessitating major constructional modifications when, for example, an additional science laboratory or art room is required. Such changes can be achieved by the addition of furniture and, in some cases, by additional plumbing as well. Bearing in mind the desire to offer greater opportunities to high school children, physical education is provided in a gymnasium, thus leaving the school hall free for assembly and speech and dramatic art training.

The Provincial Administration of the Transvaal has seconded an architect to the Institute to assist in the task of preparing documents for the building of this experimental school.

The research on school buildings was sponsored financially by the Transvaal Provincial Administration.

### Hospital Buildings

The officer in charge of this project attended a conference on planning and design of hospitals in Geneva in September, 1957, organized by the International Hospitals Federation and the International Union of Architects.

A study of measurements of nurses' journeys in eighteen wards showed that approximately 50 per cent of all journeys occurred from bed to bed, 30 per cent from service room to bed and 20 per cent between service rooms. Consequently, the service room complex should be placed as centrally as possible. The relative importance of the main service room varied with each type of ward, and in maternity and pediatric wards the duplication of sluice rooms was found to be a definite advantage. In maternity wards, the division of work between ward nurse and nursery nurse was found to be important while multiple nurseries showed considerable savings in



afstande teweeggebring is. Studies in verband met die vorm van die saal, het aangetoon dat hoe korter en hoe wyer die saal is, hoe korter die afstande.

Twee eksperimentele sale is ontwerp om die beginsels van rangskikking, wat uit hierdie studie afgelei is, te toets.

Studies van die volgende aspekte van hospitaalbeplanning word tans onderneem.

Die verkeersfrekwensie tussen die afdeling vir diagnostiese behandeling en die hospitaalafdelings om hul regte ligging en wedersydse verhouding binne die raamwerk van die plan aan te dui; die onderhoudskoste van hospitale in verhouding tot totale bedkapasiteit en die dienssterkte per bed in verhouding tot totale bedkapasiteit om die optimum bedkapasiteit vas te stel; die groei van diagnostiese en behandelingsafdelings in verskeie hospitale om inligting te verskaf vir beplanning om voorsiening te maak vir hierdie groei; kombuisbeplanning en -uitrusting en metodes om kos te bedien om die grondbeginsels vir 'n verhoging van doeltreffendheid vas te stel. Die praktyk het getoon dat skinkbordbediening dwarsdeur die hospitaal met voordeel gebruik kan word en dat kafeteria-bediening die personeel se bediening grootliks sal vereenvoudig en gereedskap bespaar. 'n Proefneming om hierdie stelsels te toets, sal in 'n nuwe vleuel van 'n hospitaal in Durban uitgevoer word; die benodigdhede vir die beplanning van X-straal-, fisio- en beroepsterapie-, buitepasiënte- en ongevalafdelings. Die instelling van 'n sentrale depot vir gesterilliseerde voorrade is 'n nuwe stap tot die modernisering van hospitale in Europa; In Suid-Afrika is hierdie stelsel egter nog slegs in een hospitaal in sy geheel toegepas. Alle beskikbare oorsese gegewens is bestudeer en 'n referaat oor die implikasies van die instelling van so 'n sentrale word tans voorberei vir publikasie. Dit wil voorkom asof dit 'n aansienlike besparing aan toerusting meebring.

Die polikliniek by Meadowlands is voltooi en in gebruik geneem. Latere waarnemings het aangetoon dat die aantal pasiëntbesoeke ooreengestem het met wat voorspel is, naamlik dat pasiëntbesoeke by die moederhospitaal met 35 persent verminder het en dat dit moontlik is om die gemeenskap se vraag na hospitaalbeddens te beraam op die basis van die verhouding van die polikliniese pasiënte wat na die hospitaal verwys word vir spesiale aandag en toelating, tot die totale bevolking wat deur die polikliniek bedien word.

'n Polikliniek is vir Saulsville ontwerp om 'n bevolking van eenvyfde van dié van Meadowlands te bedien. Die doel van hierdie studie is om te toets of die grondbeginsels vir beplanning wat in Meadowlands vasgestel is, ook geld vir 'n gebou wat 'n baie kleiner gemeenskap moet bedien.

Op die grond van die ondervinding wat tot dusver opgedoen is, gee konsultargitekthe boukundige advies aan die Transvaalse Provinsiale Administrasie by die beplanning van polikliniese dienste vir die Westelike

total journeys. Studies of ward shape showed that the shorter and wider the ward, the shorter the journeys.

Two experimental wards were designed to test the principle of arrangement derived from this study.

Studies of the following aspects of hospital planning are in hand: the frequency of traffic between diagnostic treatment and ward departments to indicate their correct disposition and relationships in plan; the running costs of hospitals in relation to total bed capacity and the service strength per bed in relation to total bed capacity in order to determine optimum bed capacity; the growth of diagnostic and treatment departments in various hospitals to provide information for planning to allow for this growth; kitchen planning and equipment and methods of serving food to establish principles for improving efficiency. Present indications are that indented-tray service could be adopted with advantage throughout the hospitals and that cafeteria service would simplify staff catering problems and save equipment. An experiment will be carried out in a new wing of a hospital in Durban to test these systems; the planning requirements for X-ray, physio- and occupational-therapy, out-patient and casualty departments.

A new development in Europe is the Central Sterile Supply Department, but only one complete example exists in South Africa. All available overseas data have been examined and a paper on the implications of the service is being prepared for publication. It would appear that considerable savings in equipment result from this service.

The Meadowlands polyclinic was completed and occupied. Subsequent observations showed that the patient attendances correspond with those predicted, that the relief on the attendances at the parent hospital is 35 per cent and that it is possible to assess the community's demand for hospital beds on the basis of the ratio of polyclinic patients referred to the hospital for specialist attention and admission to the total population served by the polyclinic.

A polyclinic was designed for Saulsville to serve a population one-fifth that of Meadowlands. The object of this study is to test whether the principles of planning established at Meadowlands are equally valid for a building serving a much smaller community.

On the basis of the experience thus far gained, consultant architectural advice is being given to the Transvaal Provincial Administration on the planning of polyclinic services for the Johannesburg Western Native Areas which will have an estimated population of 450,000 when fully developed.



Naturellegebiede van Johannesburg na skatting 'n bevolking van 450,000 sal hê as dit ten volle ontwikkel is.

Navorsing ten opsigte van hospitale word geldelik deur die Uniedepartement van Gesondheid en die vier Provinsiale Administrasies gesteun.

## FUNKSIONELE DOELTRFFENDHEID

### Bouklimatologie

In die verlede het windontleding met betrekking tot die ontwerp van geboue hoofsaaklik uit opsommings van windspoed en -rigtings bestaan, onafhanklik van mekaar. Omdat hierdie soort voorstelling as onvoldoende vir toepassing in bounavorsing en -ontwerp beskou is, is 'n meer pertinente opsomming van windtoestande voorberei vir die belangrikste bevolkingsentrums in die Unie waarin windspoed, windrigtings en frekwensie van voorkoms gekombineer is na gelang van hul onderskeie belangrikheid.

Uit 'n opname in die winter van gelyktydige binnens- en buitenshuse lugtemperatuur in onverhitte klaskamers in gebruik in Pretoria is 'n metode ontwikkel om die duur van die verwarmingstydperk en die intensiteit van die verwarmingsbehoefte van skole in verskillende dele van die land vas te stel. Die inligting behoort die ontwerpers by die keuse van die mees geskikte en ekonomiese verwarmingsinstallasie vir 'n spesifieke gebied baie te help. Soortgelyke werk in verband met verkoelingstydperk en die voorkoms van strawwe hitte in verskillende dele van die land is reeds aan die gang.

### Plafonisolasie

Vergelykende veldondersoeke waarby 'n aantal soortgelyke toetshuise gebruik word om die invloed van plafonmateriaal en verskillende soorte en diktes van plafonisolasie op binnenshuse warmtetoestande vas te stel, is voortgesit. Voorlopige resultate het bewys dat bra min voordeel behaal is deur die dikte van mineraalwol- of vermikulietisolasie met meer as 2 duim te vermeerder.

Metings wat op die plafonne van 'n paar geboue in Pretoria gedoen is, het aangetoon dat die gemiddelde graad van stofversameling sodanig is dat dit 'n refleksie-isoleermiddel wat bo-op en in direkte kontak met die plafon geplaas is, binne 'n paar jaar heeltemal ondoeltreffend as 'n isolerende materiaal sou maak. Laboratoriumtoetse het egter bewys dat as die refleksieisoleermiddel op so 'n wyse aangebring word dat dit die solderkamer in twee verkillende lugruimtes verdeel, dit 'n taamlik goeie isolasie teen sonhittevermeerdering sal bied, nie teenstaande die hoeveelheid stof wat op die oppervlakte vergader.

### Stowe vir Naturellebehuising

Kommentaar wat van verskillende gesondheids-beamptes en behuisingsowerhede ontvang is in verband

The research on hospitals is supported financially by the Union Department of Health and by the four Provincial Administrations.

## FUNCTIONAL EFFICIENCY

### Building Climatology

In the past, wind analysis in relation to building design consisted mainly of summaries of wind speeds and directions independent of each other. Since this type of presentation is considered inadequate for application to building research and design, a more pertinent summary of wind conditions was prepared for the main population centres in the Union, in which wind speed, wind direction and frequency of occurrence were combined in a manner depending on their respective importance.

From a survey of coincident indoor and outdoor air temperatures which was conducted in unheated occupied classrooms in Pretoria during the winter, a method was developed for assessing the duration of the heating period and the intensity of the heating requirements of schools in different areas in the country. The information should make it easier for designers to choose the most suitable and economical type of heating installation to employ in a particular area. Similar work in respect of cooling periods and the severity of warm weather conditions in different parts of the country is in progress.

### Ceiling Insulation

The comparative field investigations, using a number of similar test houses to determine the influence of ceiling material and different types and thicknesses of ceiling insulation on indoor thermal conditions, were continued. Preliminary results indicated that little extra benefit was derived by increasing the thickness of mineral wool or vermiculite insulation above 2 inches.

Measurements made on ceilings of a few buildings in Pretoria showed that the average rate of dust collection is such that it would render reflective insulation laid on top of and in direct contact with the ceiling, ineffective as an insulating material within a few years. Laboratory tests indicated, however, that if the reflective insulation is laid in such a manner that it divides the attic into two different air spaces, it provides fairly good insulation against solar heat gain, irrespective of the amount of dust deposited on its upper surface.

### Stoves for Native Housing

Comments received from various health officials and housing authorities on the preliminary report dealing



met die voorlopige verslag oor die gevare van koolstof-monoksiedvergiftiging in natuurlike-wonings het aange-  
toon dat die probleem deur die voorsiening van 'n  
geskikte goedkoop stoof vir beide kook- en verwarmings-  
doeleindes op die beste wyse opgelos sou kon word.  
Aangesien die Departement van Argitektuur aan die  
Universiteit van Natal reeds 'n projek aangepak het om  
meer doeltreffende goedkoop stowe vir kookdoeleindes  
te ontwerp, het dit onderneem om sy navorsing uit te  
brei deur stowe vir kook- en verwarmingsdoeleindes  
daarby in te sluit. Die eerste prototipe stowe wat ver-  
skillende vorms van brandstof gebruik, word nou  
getoets.

### **Ventilasie**

Ventilasiestudies op skaalmodelklaskamers in die 10-  
voet-windtonnel van die N.N.I.M.I. is voortgesit ten  
einde die invloed van strukturele eienskappe, windrigting  
en uitwendige obstruksies op die lugvloeiopatroon deur 'n  
gebou vas te stel.

Verder is 'n studie gemaak om die uitwerking van die  
vorm en ontwerp van ventilasie- en vensteropening op  
die hoeveelheid lugvloei deur hulle vas te stel. 'n Kennis  
van hierdie uitwerkinge het dit moontlik gemaak om 'n  
metode te ontwikkel om somer- en winterventilasieto-  
stande in kamers met 'n redelike mate van akkuraatheid  
te voorspel.

Die ventilasie van kombuise lewer sekere spesifieke  
probleme op wat normaalweg nie tot dieselfde mate in an-  
der kamers gevind word nie. Hierdie probleme spruit  
voor uit die relatiewe groot hoeveelhede reuk, hitte,  
waterdamp, vet en ander vaste stowwe wat gedurende  
die kookproses en ander verwante prosesse ontwikkel.  
Nadat die verskillende probleme bestudeer is, is aan-  
bevelings in verband met ventilasiebenodigdhede en  
-metodes vir kombuise gemaak.

### **Verligting**

Verdere toetse is uitgevoer met skaalmodelle van  
klaskamers in 'n kunsmatige hemelruim met 'n deursnee  
van 20 vt., en ook met werklike geboue onder natuurlike  
verligtingstoestand. Die doel hiervan is om die invloede  
van kleur, plafonhoogte, grondweerkaatsing, verskeie  
vorms van uitwendige obstruksies asook venstergrootte  
en rangskikking op die binneverligting vas te stel. Van  
die resultate wat verkry is, is 'n metode ontwikkel om  
skoolklaskamers te ontwerp met goeie natuurlike ver-  
ligting—sowel kwalitatief as kwantitatief.

Aandag is geskenk aan die belange van die Suid-  
Afrikaanse Nasionale Komitee vir Verligting. Hulp is  
ook verleen met die voorbereiding van verskeie publi-  
kasies wat onder andere handel oor die verligting van  
tekenkantore, die basiese benodigdhede vir binnens-  
huise verligting en die samestelling van 'n lys verligtings-  
terme.

with the dangers of carbon monoxide poisoning in Native  
dwellings indicated that the best solution to the problem  
would be the provision of a suitable low-cost dual purpose  
cooking/heating stove. As the Department of Architec-  
ture of the University of Natal had already embarked on a  
project to develop more efficient low-cost cooking  
stoves, it undertook to extend its research to include  
cooking and heating stoves. The first prototype stoves  
employing different forms of fuel are being tested.

### **Ventilation**

Ventilation studies with scale model classrooms were  
continued in the 10-ft. open jet wind tunnel of the National  
Mechanical Engineering Research Institute, with the  
object of determining the effects of structural features,  
wind direction and external obstructions on the air flow  
through a building.

In addition, a study was made of the effects of the  
shape and design of ventilation and window openings  
on the rate of air flow through them. A knowledge of  
these effects has made it possible to develop a method for  
predicting summer and winter ventilation conditions in  
rooms with a reasonable degree of accuracy.

The ventilation of kitchens presents certain specific  
problems which are normally not encountered to the  
same extent in other rooms. These problems arise from the  
relatively large amounts of odour, heat, water vapour,  
grime and grease that are produced during cooking and  
other processes associated with cooking. After studying  
the various problems recommendations were made of  
ventilation requirements and methods for kitchens.

### **Lighting**

Further tests using scale models of classrooms were  
carried out in the 20-ft diameter artificial sky, and also on  
actual buildings under natural lighting conditions, to  
determine the influences of colour, ceiling height, ground  
reflection, various forms of outdoor obstructions, and  
window size and arrangement on the indoor lighting  
conditions. From the results, a method was developed for  
designing school classrooms for good natural lighting,  
both qualitatively and quantitatively.

Time was spent in the interests of the South African  
National Committee on Illumination. Assistance was  
given in the preparation of several publications dealing  
with such aspects as the lighting of drawing offices, the  
basic requirements of the lighting of domestic interiors  
and the compilation of a vocabulary on illumination  
terminology.



## GRONDMEGANIKA

### Oorsese Besoeke

Die vierde „International Conference on Soil Mechanics and Foundation Engineering” wat gedurende Augustus 1957 in Londen gehou is, is deur 'n lid van die Afdeling bygewoon wat op dié wyse in staat was om 'n groot hoeveelheid waardevolle inligting oor die nuutste ontwikkelings in die grondmeganika uit te wissel. 'n Ander lid van die personeel het ses maande by die Afdeling Bounavorsing van die Nasionale Navorsingsraad in Kanada deurgebring, waar hy werk gedoen het op fundamentele aspekte met betrekking tot die vloei van vog deur deurdringbare media—'n faktor wat 'n belangrike rol speel by die gedrag van Suid-Afrikaanse grond.

### Nuwe Konsolidasiemeter

'n Nuwe pneumaties werkende konsolidasiemeter, wat gebruik word om die verhouding van tyd: spanning: en belasting van grond te meet, is ontwikkel en pas klaar gebou. Met hierdie apparaat kan baie groter druk op grondmonsters uitgeoefen word as wat met die bestaande apparaat moontlik was, en die aanwending van die belasting verloop baie gladder as wat vroeër die geval was. Hoë druk is nodig om die gedrag van grond te bestudeer wat onderwerp is aan die geweldige druk wat as gevolg van natuurlike uitdroging ontstaan.

### Grondopnames

Om die voordele van deeglike grondondersoek as voorbereidende stap by die beplanning van groot bou-skemas te beklemtoon, is 'n omvattende grond- en geologiese opname gemaak van die terrein wat voorgestel is vir die nuwe geboue van die Suid-Afrikaanse Buro vir Standaarde. Die inligting ingewin behoort waardevol te wees by die beplanning van die aanleg en die keuse van terrein en dit kan dus aansienlike besparings in sowel die oprigtingskoste van die geboue as hul toekomstige onderhoudskoste teweegbring.

### Voorafbenutting van Uitsettende Grond

'n Proefneming is begin waardeur 'n uitsettende grond vooraf met water benat is sodat dit kan swel. Dit is gedoen deur 'n stel boorgate wat in 'n netwerkpatroon geboor is, vir 'n paar maande met water gevul te hou. As gevolg van hierdie proefneming is waardevolle veld-gegevens verkry in verband met die koëffisiënte met betrekking tot die insypeling van water in uitsettende grond.

### Die Verwydering van Vlieg-as Afkomstig van Kragstasies

Die probleem hoe om vlieg-as afkomstig van kragstasies te verwyder deur gebruik te maak van poeierbrandstof is soortgelyk aan die by die verwydering van mynafval in die vorm van fyngemaalde klip deur gebruik

## SOIL MECHANICS DIVISION

### Overseas Visits

The Fourth International Conference on Soil Mechanics and Foundation Engineering held in London during August, 1957, was attended by a member of the Division who was thus able to exchange a good deal of valuable information on the more recent developments in soil mechanics. Another member of staff spent six months at the Division of Building Research of the National Research Council in Canada where he carried out work on fundamental aspects of the flow of moisture through porous media—a subject which has a very important bearing on the behaviour of South African soils.

### New Consolidometer

A new, pneumatically operated consolidometer which is used to measure the time : strain : load relationships of soils was developed and its construction completed. This apparatus is capable of applying very much larger pressures to soil samples than can be done with existing apparatus, and the application of load is very much smoother than has been possible before. High pressures are required to study the behaviour of soils which have been subjected to the enormous stresses caused by natural desiccation.

### Soil Surveys

To emphasize the advantages obtainable from an adequate soil investigation as a preliminary step in planning large building schemes, a comprehensive soil and geological survey was carried out on the site proposed for the new buildings of the South African Bureau of Standards. The information gained should prove of value in the planning of layouts and in the selection of sites, and could thus lead to considerable savings both in the erection of the buildings and in their future maintenance.

### Pre-Watering of Expansive Soils

An experiment was commenced in which an expansive soil was made to heave by pre-watering. This was done by keeping a set of boreholes drilled in a grid pattern, filled with water, for several months. From this experiment valuable field data were obtained on the coefficients relating to the flow of water into expansive soils.

### Disposal of Flyash from Power Stations

The problem of the disposal of flyash from power stations using pulverized fuel is similar to that of disposing of mine waste in the form of finely ground rock by using slime dams—a problem which has occupied the attention of the Soil Mechanics Division for several



te maak van slykdamme—'n probleem wat die aandag van die Afdeling Grondmeganika al vir 'n hele paar jaar in beslag geneem het. Die Elektrisiteitsvoorsieningskommissie ondersteun navorsing ten opsigte van die ontwerp van geskikte vliegdamme.

#### **Verwering van Doleriet**

'n Begrip van die verwering van stollingsgesteentes waardeur kleie en ander grondbestanddele gevorm word, is van fundamentele belang vir 'n kennis van die gedrag van grond met betrekking tot geboue en paaie. Navorsing in hierdie rigting is begin deur 'n grondige studie te maak van die verwering van 'n reeks dolerietgange van verskillende ouderdomme en wat blootgestel is aan verskillende toestande van verwering. Daar word vertrou dat hierdie werk tot die verkryging van meer inligting sal lei in verband met die moontlike vinnige verwering van padmateriale wanneer hulle onderworpe is aan die eienaardige stelsel van groot temperatuurkommelings, druk en vogtigheidstoestande onder 'n padoppervlakte.

### **AFDELING SIVIELE INGENIEURSWESE**

#### **Betontechnologie**

##### *Nie-verniëgende Toetsmetodes vir Beton*

Ondersoeke na die invloed van ouderdom, water/sementverhouding en mengverhoudings op die verband tussen die polsspoed en die drukvastheid van beton is voortgesit. Dit blyk dat die verband vir praktiese doeleindes as onafhanklik van ouderdom en water/sementverhouding beskou kan word, alhoewel, statisties gesproke, die ontleding laat vermoed dat die verband onder sekere omstandighede nie streng onafhanklik van hierdie faktore is nie. Navorsing is ook gedoen met betrekking tot die verhouding vir beton van dieselfde bewerkbaarheid maar van verskillende aggregraat/sement- en water/sementverhoudings en ouderdom.

##### *Toetse vir sementkwaliteit*

Ondersoeke is aan die gang om vas te stel of 'n indirekte trekvastheidstoets op sement-mortelsilinders van 2 dm. deursnee en 2 dm. lengte, gebruik kan word as 'n standaardtoets vir sementkwaliteit. Daar is aanduidings dat die aard van die pakkingmateriaal tussen die drukplaat van die toetsmasjien en die toetsmonster 'n duidelike uitwerking het op die resultate wat verkry is.

##### *Kwaliteitskontrole van beton*

Ondersoeke is voortgesit op die beton gebruik vir die nuwe geboue wat vir die W.N.N.R. opgerig word asook by die bou van die Piensaarsrivierdam, om die faktore vas te stel wat die verskille in betonkwaliteit onder terreinomstandighede veroorsaak.

##### *Geldelik gesteunde ondersoeke*

Geldelik gesteunde ondersoeke is onderneem in verband met die gebruik van vlieg-as en korrelrige

years. Research on the design of suitable flyash disposal dams is being sponsored by the Electricity Supply Commission.

#### **Decomposition of Dolerite**

An understanding of the decomposition of igneous rocks to form clays and other soil constituents is of fundamental importance to a knowledge of the behaviour of soils in relation to buildings and roads. A step has been taken in this field by undertaking a detailed study of the decomposition of a series of dolerite dykes of different ages which have been subjected to different conditions of weathering. This work, it is hoped, will lead to more information on the possible rapid weathering of road materials when subjected to the peculiar regime of widely varying temperatures, pressures and moisture conditions under a road surface.

### **CIVIL ENGINEERING**

#### **Concrete Technology**

##### *Non-destructive methods of testing concrete*

Investigations continued in connection with the effects of age, water/cement ratio and mix proportions on the relationship between pulse velocity and the compressive strength of concrete. It appears that, for practical purposes, the relationship may be regarded as being independent of age and water/cement ratio although statistical analysis suggests that, under certain conditions, the relationship is not strictly independent of these factors. Research into the relationship for concrete of equal workability, but having different aggregate/cement and water/cement ratios and age, was also carried out.

##### *Tests for cement quality*

Investigations are in progress to determine whether an indirect tensile test on cement mortar cylinders 2 in. in diameter and 2 in. in length may be used as a standard test for cement quality. There are indications that the nature of the packing material between the platens of the testing machine and the test specimen has a pronounced effect on the results obtained.

##### *Control of concrete quality*

Investigations were continued on the concrete used in the new buildings being erected for the C.S.I.R. and also in the construction of the Pienaar's River Dam, to ascertain the factors causing variations in concrete quality under site conditions.

##### *Sponsored investigations*

Sponsored investigations were undertaken in connection with the use of flyash and granulated blast-furnace

hoogoondslak in beton sowel as met baie ander betonprobleme.

#### *Voorgespanne beton*

Navorsing ten opsigte van die bryvulling rondom kabelhuise in voorgespanne betonkonstruksie het ondersoek ingesluit na die eienskappe van verskillende voegbrymengsels en die gebruik van 'n radio-isotooptegniek as metode om die doeltreffendheid van die bryvulling vas te stel.

'n Referaat oor bogenoemde werk is geskryf en sal aangebied word op die derde Kongres van die „International Federation for Prestressed Concrete” wat in Mei 1958 te Berlyn gehou word.

#### **Die Gebruik van Hout vir Strukturele Doeleindes**

Daar is 'n groeiende belangstelling in die gebruik van hout vir bouwerk in Suid-Afrika. 'n Vergadering met die verteenwoordigers van 'n hele aantal liggame wat in die gebruik van hout in die boubedryf en siviele ingenieurswese belangstel, is by die Instituut gehou om die behoefte en omvang van navorsing op hierdie gebied vas te stel. Navorsing is gedoen om die eienskappe van gelamelleerde houtbalke te bepaal.

#### **Brandnavorsing**

Die stelsel van brandverslaggewing op 'n nasionale basis wat deur die Instituut voorgestel is, funksioneer goed. Verslae van alle brande word in kode omgesit en die inligting word weergegee op geponste kaarte. Die ontleding van die inligting wat in 1957 verkry is, vorder goed.

'n Opname van die soort aparate wat in ander lande gebruik word vir brandtoetsdoeleindes, is gedoen met die doel om te help met die besluit oor watter apparaat nuttig en ekonomies in Suid-Afrika gebruik kan word.

Navorsing ten opsigte van die brandweerstand van grasdakke is op tou gesit.

#### **Riolering en Sanitasie**

Volgens navrae wat ontvang is, is dit duidelik dat daar heelwat probleme in Suid-Afrika voorkom in verband met die verwydering van rioolvuil in klein gemeenskappies waar daar nie spoelriolering bestaan nie. In samewerking met die Afdeling Waternavorsing van die Nasionale Chemiese Navorsingslaboratorium is 'n voorlopige opname van die probleme gedoen.

#### **Strukturele Ingenieurswese**

##### *Skuiwsgigting in gewapende betonbalke*

Aansienlike vooruitgang is gedurende die jaar gemaak op die gebied van ondersoek in verband met skuiwsgigting in gewapende betonbalke. Die eerste deel van die ondersoek in verband met die uitwerking van die a/d-verhouding op die skuiwkrag van gewapende betonbalke is voltooi. 'n Apparaat is ontwerp vir die aanwending van end-

slag in concrete, as well as on many other concrete problems.

#### *Prestressed Concrete*

Research on the grouting of cable ducts in prestressed concrete construction included investigations of the properties of various grout mixes and the use of a radio-isotope technique as a means of determining the efficacy of the grouting.

A paper on the above mentioned work was written and will be presented at the Third Congress of the International Federation for Prestressed Concrete to be held in Berlin in May, 1958.

#### **Use of Timber for Structural Purposes**

There is growing interest in the use of timber for building in South Africa. A meeting with representatives from a large number of bodies interested in the use of timber in the building and civil engineering industries was held at the Institute in order to assess the need and scope for research in this field. Some research was carried out on the properties of laminated timber beams.

#### **Fire Research**

The system of fire reporting on a national scale, introduced by the Institute, is functioning well. Reports of all fires are now coded and the information recorded on punched cards. The analysis of the information obtained for 1957 is in progress.

A survey was made of the types of apparatus being used for fire-testing purposes in other countries in order to assist in deciding what apparatus could be usefully and economically employed in South Africa.

Research into the fire resistance of thatched roofs was commenced.

#### **Sewerage and Sanitation**

From enquiries received it is obvious that numerous problems are being encountered in South Africa in connection with sewerage disposal in small communities where no water-borne sewerage exists. In co-operation with the Water Research Division of the National Chemical Research Laboratory, a preliminary survey of the problems has been made.

#### **Structural Engineering**

##### *Shear failure in reinforced concrete beams*

Considerable progress was made with investigations of shear failure of reinforced concrete beams. The first section of the investigation in connection with the effect of the a/d relationship on the shear strength of reinforced concrete beams was completed. Apparatus has been



momente by gewapende betonbalke, onafhanklik van die momente wat as gevolg van die belasting wat gewoonlik aangewend word, ontstaan.

#### *Spannings en vormveranderinge in gewapende beton as gevolg van krimpings*

Verdere navorsing is uitgevoer om die spannings en vormveranderinge vas te stel wat plaasvind in beton wat van „krimpende” aggregate gemaak is. Daar is gevind dat krimpingspannings in betonbalke wat van krimpende aggregate gemaak is, partykeer tot nege keer groter is as die in 'n soortgelyke balk wat van suiwer aggregate gemaak is. Defleksies was ook ongeveer nege keer so groot. Verder is gevind dat, alhoewel defleksie in betonbalke wat van krimpende aggregate gemaak is, verhoed word deur wapening aan die bo- en onderkant, ernstige kraging van die balke plaasvind as gevolg van die groot spannings wat veroorsaak word omdat krimpings op hierdie wyse gestuit word.

#### *Strukturele implikasies in verband met die korrosie van staalwapening in beton*

Daar is met 'n uitgebreide ondersoek begin om die uitwerking van verskillende deklare op bindeienskappe vas te stel asook op die voorkoming van korrosie van wapeningsstaal.

#### *Geldelike gesteunde ondersoek*

Geldelik gesteunde navorsing is ook onderneem na die eienskappe van staaldraad met 'n hoë treksterkte vir gebruik in voorgespanne beton, die doeltreffendheid van endankerings en die wrywingsverliese in voorgespanne betonkonstruksie.

## MATERIALE

### Algemeen

'n Simposium oor die chemiese eienskappe van boumateriale is gedurende die elfde Jaarlikse Konvensie van die S.A. Chemiese Instituut gereël, waar referate gelewer is deur verskillende lede van die Afdeling. Die vraag na kontrakwerk en die aantal navrae wat ontvang is, het vermeerder en vorm nog steeds 'n aansienlike deel van die Afdeling se werksaamhede.

### Verwe

Vedere laboratorium- en veldevaluasie van die gedrag van verbeterde dakverwe wat in die Instituut ontwikkel is, het hul meerderwaardigheid bo kommersiële dakverwe bevestig. Die belangrikste verfvervaardigers in die land is nou in 'n posisie om hierdie verwe, wat in steeds groter mate gebruik word, te lewer.

Drie tipes witkalk wat op verdere navorsing gebaseer is en wat goed hou vir buitenshuise gebruik is ontwikkel; hierdie materiale is van besondere belang vir goedkoop

designed for the application of end moments to reinforced concrete beams independently of the moments due to the usual applied loads.

#### *Stresses and deformations in reinforced concrete due to shrinkage*

Further work was carried out to determine the stresses and deformations which occur in concrete made with “shrinking” aggregates. It was found that shrinkage strains in concrete beams made with shrinking aggregates may be up to nine times as great as those in similar beams made with sound aggregates. Deflections were also approximately nine times as great. Furthermore, it was found that although deflection in concrete beams made with shrinking aggregates is prevented by having reinforcement at both top and bottom, severe cracking of the beams takes place due to the large stresses induced by restraining shrinkage in this way.

#### *Structural implications of the corrosion of steel reinforcement in concrete*

A comprehensive investigation was commenced to determine the effects of different coatings on bonding properties as well as on the prevention of corrosion of reinforcing steel.

#### *Sponsored investigations*

Sponsored research was also undertaken into the properties of high tensile steel for use in prestressed concrete, the efficiency of end anchorages and the friction losses in prestressed concrete construction.

## MATERIALS

### General

A symposium on the Chemistry of Building Materials was arranged during the 11th Annual Convention of the S.A. Chemical Institute at which papers were presented by several members of the Division. The demand for contract work and the number of enquiries received has increased and continues to account for a considerable proportion of the Division's activities.

### Paints

Further laboratory and field evaluation of the performance of improved roof paints developed in the Institute has confirmed their superiority to commercial roof paints. The major paint manufacturers in the country are now in a position to supply these paints, which are being used to an increasing extent.

Based on further research, three types of whitewash of good durability in exterior service have been developed; these materials are of special importance in low-cost

behuising omdat hulle 'n relatiewe goedkoop behandeling bied vir die voorkoming van waterdeurdringing deur mure. 'n Vervaardiger is op die oomblik besig om witkalk te vervaardig wat op hierdie werk gebaseer is.

#### **Bestandheid van Geboue teen Waterdeurdringing**

Die feit dat waterdeurdringing deur baksteenwerk aansienlik verminder kan word deur die gebruik van plastiese mortels, is onteenseglik bewys. Toetse op die reëndeurdringingskenmerke van mure wat vyf jaar gelede gebou is, toon aan dat dié wat van ligte blokke gebou is, aansienlik versleg het, terwyl baksteenmure min verandering getoon het. 'n Nuwe vinnige metode vir die voggehaltebepalings van mure wat ter plaatse toegepas word, het belowende resultate opgelewer en word verder bestudeer.

#### **Bouklip**

'n Opname van die gedrag van bouklip is dwarsdeur die land onderneem en die resultate is vergelyk met dié van 'n soortgelyke opname wat ongeveer dertig jaar gelede gedoen is. Die verwerking van klip met betrekking tot hulle gebruik is ook bestudeer en verskeie probleme in verband met die gebruik en skoonmaak van klip in geboue is ondersoek.

#### **Gebakte Kleiprodukte**

'n Lid van die personeel het hierdie materiale die afgelope jaar oorsees bestudeer en het spesiale aandag geskenk aan die probleme wat voorkom in die gebruik van kleie in steenvervaardiging. Die doelmatigheid van 'n teenkimmiddel, die bars van sierstene en die mineralogie van steenkleie is verder bestudeer. Dit het geblyk dat bevredigende gebakte stene van vlieg-as, 'n afvalprodukt van kragstasies, geproduseer kan word as die steen met klein hoeveelhede klei gemeng word.

#### **Korrosie van Wapeningstaal in Beton**

Navorsing in verband met die probleem van korrosie van wapeningstaal in beton, is aktief voortgesit in die laboratorium sowel as in die veld. Tot dusver het die werk die blootstelling en waarneming van sowat 2,400 betonmonsters ingesluit. Op hierdie wyse is die doelmatigheid van verskillende metodes om korrosie van staal te verminder, sistematies ondersoek en daar is baie belowende resultate behaal; daar is byvoorbeeld gevind dat die gebruik van sekere chroombevattende semente baie doeltreffend is.

Die verbinding tussen staal en beton is ook ondersoek in samewerking met die Afdeling Siviele Ingenieurswese.

#### **Sement en Sementprodukte**

Werk in verband met die uitwerkings van die atmosfeer op vars sementprodukte het aan die lig gebring dat super-sulfaatslakkesementprodukte, in teenstelling met Portlandsementprodukte, nie verder sterkte ontwikkel as hulle

housing as they provide a relatively cheap treatment for preventing water penetration through walls. A manufacturer is currently producing a limewash based on this work.

#### **Water Resistance of Buildings**

The fact that water penetration through brickwork can be considerably reduced by the use of plastic mortars has been clearly established. Tests on the rain penetration characteristics of walls built five years ago indicate that those built of light-weight block have deteriorated considerably, while brick walls have shown little change. A new rapid *in situ* method for moisture content determination of walls has given promising results and is being studied further.

#### **Building Stones**

A survey of the performance of building stones throughout the country was undertaken and the results compared with those of a similar survey made some thirty years ago. The processing of stones in relation to their use was also studied and various problems associated with the use and cleaning of stone in buildings were investigated.

#### **Burnt Clay Products**

A member of the staff has been studying these materials overseas during the past year, paying special attention to problems on the use of clays in brick manufacture. The efficacy of an anti-scumming additive, the cracking of face-bricks and the mineralogy of brick clays have been further studied. It has been shown that satisfactory burnt bricks can be produced from flyash, a waste product from power stations, if mixed with small amounts of clay.

#### **Corrosion of Reinforcing Steel in Concrete**

Research into the problem of the corrosion of reinforcing steel in concrete has proceeded actively both in the laboratory and in the field. The work has so far involved the exposure and observation of some 2,400 concrete specimens. In this way the efficacy of various methods of reducing corrosion of the steel is being systematically investigated with very promising results; for example, the use of certain chromium-containing cements has been found to be very effective.

The bond between steel and concrete is also being investigated in collaboration with the Civil Engineering Division.

#### **Cement and Cement Products**

Work on the effects of the atmosphere on fresh cement products has revealed that, in contrast to Portland cement products supersalted slag cement products, once dried out, do not develop further strength. Furthermore,



eers uitgedroog is nie. Verder is sulke semente baie sensitief vir koolstofdioksied en, as hulle onbeskermd is, het die koolstofdioksied in die lug 'n poeieragtige produk van swak gehalte, veral in die oppervlakke, tot gevolg. Dit kan verminder of verhoed word deur gebruik te maak van vliesvormende nabehandlingsverbindings.

Ondersoek het aan die lig gebring dat die gebruik van waterbehandeling, digte beton en sekere oppervlakke doeltreffend is om die aantasting van beton deur sagte waters te verminder.

Daar word aangetoon dat die graad van aantasting van beton deur sulfate, hoofsaaklik bepaal word deur die aard van die sulfate; ammonium- en magnesiumsulfate is baie aggressiewer as kalsiumsulfate. Die samestelling van die sement en die nabehandlingsomstandighede beïnvloed in 'n groot mate gevoeligheid daarvan vir sulfaataantasting.

### Aggregate

Navorsing op Suid-Afrikaanse betonaggregate wat abnormale dimensionele veranderinge in die sementprodukte wat hulle bevat, teweegbring, het tot die ontwikkeling van twee eenvoudige bevredigende veldtoetse vir die identifisering van sulke aggregate gelei. Die resultate van toetse wat onafhanklik deur vyf laboratoriums uitgevoer is het 'n hoë mate van ooreenkoms getoon.

'n Belangrike verband is tussen die interne oppervlakte van aggregate en hul gedrag ten opsigte van dimensionele verandering in sementprodukte gevind. Studies op sulke produkte waar sensitiewe meettoerusting gebruik is, het getoon dat veranderinge in die relatiewe voggehalte van die omringende lug dimensionele veranderinge so groot as dié wat deur benatting en uitdroging teweeggebring word, veroorsaak hoewel hulle stadiger verloop. Dit het ook bewys dat die uitwerking van die vogtigheidsveranderinge buite verhouding groot is by baie hoë en lae voggehaltes.

Hierdie werk wat gedeeltelik geldelik gesteun word deur die „Concrete Association of South Africa”, het tot 'n meer algemene waardering van die ingewikkeldheid van hierdie interessante en buitengewone probleem bygedra. Inligting oor die praktiese implikasies van die resultate van hierdie navorsing is van groot ekonomiese belang vir die bou-bedryf in Sentraal- en Noord-Kaapland, Natal en die Vrystaat.

### Boukalk

Die Suid-Afrikaanse Buro vir Standaarde het 'n Suid-Afrikaanse Standaardspesifikasie (Nr. 523 van 1957) gepubliseer getitel *Kalk vir Boudoeleindes*, wat hoofsaaklik gebaseer is op navorsing op hierdie gebied wat deur die Instituut uitgevoer is.

Basiese werk oor die chemie van kalk het gelei tot die bevinding dat sekere onsuiverhede in kalk 'n groot vermindering van die snelheid van blussing veroorsaak wat lastig kan wees in die produksie van goeie boukalk.

such supersulphated cements are very sensitive to carbon dioxide and, if unprotected, the carbon dioxide in the atmosphere leads to a powdery product of poor quality, particularly in the surface layers. This can be reduced or prevented by the use of skin-forming curing compounds.

Investigation has revealed that the use of water treatments, dense concrete, and certain surface coatings are effective in reducing the attack of concrete by soft waters.

The severity of attack of concrete by sulphates has been shown to be largely determined by the nature of the sulphates, ammonium and magnesium sulphates being much more aggressive than calcium sulphates. The composition of the cement and the curing conditions also profoundly affect its vulnerability to sulphate attack.

### Aggregates

Research into South African concrete aggregates which produce abnormal dimensional changes in the cement products that contain them, has led to the development of two simple satisfactory field tests for identifying such aggregates. Good agreement was found between the results of tests independently carried out by five laboratories.

A significant relationship between the internal surface area of aggregates and their dimensional change behaviour in cement products was found. Studies on such products using sensitive measuring equipment showed that changes in the relative humidity of the ambient air cause dimensional changes as large as those resulting from wetting and drying, though slower, and that the effect of humidity changes is disproportionately large at very high and low humidities.

This work which was partially financed by the Concrete Association of South Africa (now known as the Portland Cement Institute) has led to a more general appreciation of the complexity of this interesting and unusual problem. Information on the practical implications of the results of this research is of considerable economic importance to the building industry in the Central and Northern Cape, Natal and the Free State.

### Building Lime

The South African Bureau of Standards has published a South African Standard Specification (No. 523—1957) for *Limes for Use in Building*, which is largely based on research in this field carried out at the Institute.

Fundamental work on the chemistry of lime has led to the finding that certain impurities in lime lead to a marked reduction of the rate of slacking, which can be a problem in the production of sound building limes.

Studies oor die swakheid van kalk toon dat die byvoeging van korrelrige materiale en hul aard en korrelgrootte 'n belangrike rol in die vermindering van uitsetting speel —'n ontdekking van groot belang in die gedrag van pleisters en mortels

'n Goeie begin is gemaak met die studie van die vloeieienskappe van kalk en sementpasta met behulp van roterende viskosimeters, en met die studie van die vloeieienskappe van mortels deur middel van skuiftoetse. As gevolg van hierdie werk kan 'n monster so klein as een ons kalk binne 'n paar minute getoets word, en benewens ander gegewens kan die drempelwaarde, 'n fundamentele eienskap wat volgens bewyse proporsioneel aan die empiriese Emley-plastisiteit is, bereken word.

Studies on the unsoundness of lime show that the addition of granular materials and their nature and grading play an important part in reducing expansion—a finding of considerable importance in the behaviour of plasters and mortars.

A fundamental approach was made to the study of the flow properties of lime and cement pastes by rotational viscometry techniques, and to the study of the flow properties of mortars by means of shear box tests. As a result of this work a sample of as little as one ounce of lime can be tested in a matter of minutes, and, amongst other data, the yield value, a fundamental property which has been shown to be proportional to the empirical Emley plasticity, can be assessed.



# Nasionale Instituut vir Personeelnavorsing

*Direkteur:* DR. S. BIESHEUVEL

Oor die tydperk April 1957-Maart 1958 is navorsing in verband met 72 projekte gedoen. Hiervan is 25 ter nakoming van kontrakte gedoen, 5 met behulp van navorsingstoekennings; 4 is kosteloos vir staatsdepartemente onderneem, en in 38 gevalle het die Wetenskaplike en Nywerheidsnavorsingsraad die voortou geneem en hulle uitgevoer. By die kontrakte was 'n bedrag van £27,740 gemoeid en by die toekennings £5,800. Bowendien is inkomste ten bedrae van £1,410 ontvang uit beroepsvoorligting (192 gevalle) en roetinepersoneelkeuring vir klein nywerhede (161 gevalle).

Die totale aantal persone wat in die verskillende personeelkeuringsprojekte wat 'n bron van inkomste gevorm het, behandel is, het 1,751 beloop. Bowendien is 640 persone getoets om hul aanleg vir betrekings by die Wetenskaplike en Nywerheidsnavorsingsraad vas te stel en duisende is vir navorsingsdoeleindes of in die loop van standaardiseringsdoelsete gekeur.

Twintig verhandelings van lede van die Instituut is in wetenskaplike tydskrifte gepubliseer en talryke tegniese verslae is aan ondersteuners verstrekkend oor die vordering van ondersoek en aan ander organisasies wat by die Instituut aangeklop het om raad by hul personeelprobleme.

## PERSONEELKEURING

Die vernaamste taak van die personeelkeuringsdepartement wat blanke werknemers betref, lê nog steeds op die gebied van personeel vir die Verdedigingsmag. Die Instituut is verantwoordelik vir die toepassing van klassifikasie- en keuringstoetse op vliegtuigbemanning, potensiele offisier-kadette, grondpersoneel van die Lugmag, ambagsleerlinge, instruktors en verskillende tegniese kategorieë sowel as personeel wat nie goed by hul werk aanpas nie. Min nuwe terrein is gedurende die jaar ontgin behalwe dat die werk van radiobediens (lug) ondersoek is en nuwe keuringsmetodes vir hierdie lugpersoneelgroep ingevoer is; die resultate is veelbelovend. Die totale aantal persone vir die Verdedigingsdepartement getoets, het 1,357 beloop. Belangrike navorsingswerk het die verbetering van bestaande toetsbatterye in die lig van opvolgdata beoog. Besondere aandag is bestee aan toetse vir leierskapaanleg wat veral van belang is by die uitsoek van offisier-kadette.

Die versoeke om ambagsleerlinge te toets neem toe. Kleinere nywerhede begin gebruik maak van die

# National Institute for Personnel Research

*Director:* DR. S. BIESHEUVEL

The projects on which research was done numbered 72. Of these 25 were carried out in the course of contracts, 5 were covered by research grants, 4 were undertaken for state departments free of charge, and 38 were initiated and carried out entirely by C.S.I.R. The value of the contracts amounted to £27,740 and of the grants to £5,800. In addition, revenue was received from vocational guidance (192 cases) and routine personnel selection for smaller industries (161 cases) amounting to £1,410.

The total number of persons handled in the various personnel selection projects covered by income was 1,751. In addition, 640 persons were aptitude tested for appointments within the C.S.I.R., and thousands were tested for research purposes, or in the course of standardizing tests.

Institute members also published 20 papers in scientific journals and submitted numerous technical reports to sponsors on the progress of investigations and to other organizations which consulted the Institute on personnel problems.

## PERSONNEL SELECTION

The major effort of the personnel selection department, in so far as European employees are concerned, is still in the field of Defence personnel. The Institute is responsible for the application of classification and selection tests to aircrew, potential officer cadets, Air Force ground staff, artisan apprentices, instructors, and various technical categories, as well as to personnel maladjusted to their duties. Little new ground was broken during the year except that the duties of wireless operators (air) were examined and new selection procedures were introduced for this aircrew category, which have given promising results. The total number of persons tested for the Department of Defence was 1,357. Major research effort was directed to the improvement of existing test batteries in the light of follow-up data. Particular attention was paid to tests of leadership capacity which are particularly important in the selection of officer cadets.

The demand for tests for artisan apprentices is increasing. Smaller industries are beginning to avail

fasiliteite deur die Instituut gebied vir roetinetoetsing van applikante vir vakleerlingskap. 'n Langtermynondersoek van die nut van die vakleerlingtoetsbattery as 'n voor-speller van sukses gedurende die opleidingstydperk is voltooi. Dit het heelwat moeite gekos om 'n geskikte maatstaaf vir sukses vas te stel vanweë die feit dat vakleerlinge nie die eksamens van Tegniese Skole hoef te slaag nie of die Nasionale Tegniese Sertifikaat hoef te verwerf nie. Daar is egter gebruik gemaak van die staats-ambagstoetse en die spesiale ambagstoetse deur die Instituut uitgewerk. Dit het geblyk dat daar 'n bevredigende verband tussen toetse en hierdie toetsmaatstawwe bestaan.

Die toets van applikante om aanstelling by die Wetenskaplike en Nywerheidsnavorsingsraad is tans 'n gevestigde prosedure. Hierdie toetsprogram bied 'n gulde geleentheid vir die ontwikkeling van metodes om met personeel vir die hoër poste te handel by wie die besit van sekere persoonlikheidsienskappe eerder as onderwyskwalifikasies die belangrikste is. Die toets is toegepas by die keuring van direkteure van navorsingslaboratoriums en hoofadministrasiebeamptes. Dergelike hulp is aan die Nywerheid verleen by die uitsoek van bestuurs- en uitvoerende beamptes.

In die geheel is 161 gevalle met inbegrip van vakleerlinge ten behoeve van die nywerheid behandel.

#### **Bepoepsvoorigting**

Versoeke om beroepsvoorigting het gestadig toeneem en was hoofsaaklik afkomstig van leerlinge uit die matriekklas, dié wat van plan is om na 'n universiteit te gaan, en van studente wat moeite met hul universiteitstudies ondervind. Aangesien beroepsvoorigting slegs 'n bykomstige funksie van die Instituut is wat uitgevoer word as die aanvraag om personeelkeuringswerk dit toelaat, was dit nie moontlik om aan alle versoeke te voldoen nie. In die geheel is 167 aanvraers te woord gestaan. Die Instituut sal voortgaan om hierdie diens te lewer tot tyd en wyl voldoende geriewe elders beskikbaar is. Dit sal miskien nodig word om uitbreiding van die Departement te oorweeg as die toestroming van versoeke voortduur.

Die Departement Psigometrie het voortgegaan met die opstel van 'n stel beroepsvoorigtingstoetse vir die Arbeidsdepartement. Hierdie toetse het die punt bereik waarop hulle eksperimenteel toegepas kon word op willekeurig gekose groepe jong mense aan wie die Departement hulp verleen het om 'n geskikte werkkring te vind. Daar is bevind dat sowel die bekwaamheids- as die motiveringspeil laag was, en eersgenoemde selfs benede die peil van normale skoliere. Dit het hersiening van die toetse wat te moeilik vir hierdie groep was, nodig gemaak. Die uitwerk van hierdie toetsbattery was 'n geweldige taak. Dertig subtoetse is opgestel waarvoor 2,000 hulpmiddels vervaardig is. Tot dusver is al hierdie

themselves of the facilities provided by the Institute for the routine testing of applicants for apprenticeships. A long-term study of the usefulness of the apprentice test battery as a predictor of success during the training period has been completed. Much difficulty was experienced in the establishment of a suitable criterion of success, in view of the fact that apprentices need not qualify in Technical College examinations or take the National Technical Certificates. Use was, however, made of the government trade tests and special trade tests designed by the Institute. The relationship between tests and these criteria was proved to be satisfactory.

The testing of applicants for appointment in the C.S.I.R. is now an established procedure. This testing programme offers useful opportunities for the development of techniques to deal with high-level personnel in whom the presence of certain personality qualities rather than educational qualifications is the most significant point. The tests have been used at the level of directors of research laboratories and chief administrative officers. Similar assistance has been given to Industry in the selection of managerial and executive personnel.

A total of 161 cases was dealt with on behalf of industry, inclusive of apprentices.

#### **Vocational Guidance**

There has been a steady increase in the demand for vocational guidance, mainly from pupils in matriculation classes, from those intending to enter University, and from students experiencing difficulties in their University studies. As vocational guidance is only an incidental function of the Institute, carried out when the demand for personnel selection work permits, it has not been possible to meet the demand fully. A total of 167 cases was seen. The Institute will continue to render this service until such time as adequate facilities may be available elsewhere. Consideration may have to be given to an enlargement of the Department if the demand continues.

The Psychometric Department continued with the construction of a set of vocational guidance tests for the Department of Labour. These tests reached the stage where they could be applied experimentally to samples of young persons who were assisted by the Department in finding suitable jobs. It was found that both abilities and motivation were low, the former well below the level of a normal school population. This necessitated a revision of the tests, which proved too difficult for this group. The construction of this test battery has proved an immense task; 30 sub-tests were drawn up for which 2,000 items were constructed. So far all these tests have been applied to 2,000 persons and an item analysis has been conducted on 1,000 cases. From this analysis, the tests will be constructed into their final form. Some ingenious new



toetse op 2,000 persone toegepas en in 1,000 gevalle is die resultate punt vir punt ontleed. Op grond van hierdie ontleding sal die toetse in hul finale vorm gegiet word. 'n Paar vernuftige nuwe bekwaamheidstoetse is vir die battery uitgewerk: onder andere 'n toets om beroepsbelangstelling en -houdings teenoor beroepe vas te stel en 'n toets om klerklike bekwaamheid te bepaal. Dit lyk asof hierdie toetse besonder doeltreffend sal wees. Gebrek aan beroepsbelangstelling en motivering is opvallend by baie van die kinders wat deur die hande van die Departement van Arbeid gaan en dit sal nog moet blyk in watter mate beroepsvoorligtingstoetse 'n sukses sal wees in hierdie gevalle sonder die een of ander aansporing om die houding van die betrokke persone te verander.

#### INTELLIGENSietoets VIR VOLWASSENES

Die standaardisering van die Wechsler-Intelligensietoets vir Volwasse nes vir gebruik in Suid-Afrika vorder maar bra stadig. Dit is moeilik om die samewerking van volwasse proefpersone op sekere leeftye en in sekere maatskaplik-ekonomiese groepe te verkry. Gevolglik is daar nog te min gevalle in sekere kategorieë om preliminêre standaardisasie moontlik te maak. Dit is tans onwaarskynlik dat die toets, selfs in 'n voorlopige vorm, voor die einde van 1958 beskikbaar sal wees.

#### TOETSE VIR DIE KLASIFISERING VAN NATURELLEARBEID

Daar is nog steeds behoefte aan die invoering van toetse vir die klassifisering van naturellearbeid in die nywerheid. In die loop van die jaar is die toetse by 'n steenkoolmyn, die boubedryf en 'n klerefabriek ingevoer. Hierdie toetse is ook op 'n deursnee van die naturellearbeid in diens van die Johannesburgse munisipaliteit toegepas ten einde die nut daarvan as 'n klassifiseringsmiddel vir hierdie soort arbeid te bepaal.

Beamptes wat met die administrasie van die toetse vir die klassifisering van naturelle personeel in die nywerheid belas is, is gewoonlik nie professioneel gekwalifiseer nie. Hulle moet dus eers opgelei word in die regte gebruik van hierdie toetsbattery. Hierdie opleiding is in die verlede *ad hoc* gegee dog met die oog op die toenemende vraag het die Instituut tans 'n opleidingskursus van ses weke ingestel wat voortaan twee maal per jaar gegee sal word. Dit is 'n essensiële diens om die toetse deur die Instituut uitgewerk van praktiese waarde vir die nywerheid te maak en om te verseker dat hulle behoorlik gebruik word.

Daar is goed gevorder met die studie van die faktore wat die geskiktheid van Bantoestaatsamptenare vir hul werk bepaal. Die manier waarop laasgenoemde die vereistes vir hul werk benader en dié waarop dieselfde werk deur blanke opsigters benader word, is duidelik gedefiniër. Die aard van gevalle van tevredenheid en van ontevredenheid met die werk is ook ontleed. Deur middel van aldus verkreë inligting is die soort persoon-

ability tests have been constructed for the battery, which also includes a test of vocational interests and attitudes and one of clerical ability which looks particularly promising. Lack of vocational interests and motivation is noteworthy in many of the children dealt with by the Department of Labour and it remains to be seen to what extent vocational guidance tests can prove successful in these cases without some stimulus to alter the attitudes of the persons concerned.

#### ADULT INTELLIGENCE TEST

Progress in the standardization of the Wechsler Adult Intelligence Test for South African use continues to be slow. It is difficult to obtain the co-operation of adult subjects at certain age levels and in certain socio-economic groups. As a result, there are still too few cases in certain categories to enable a preliminary standardization to be made. It is unlikely now that the test, even in an interim form, will be available by the end of 1958.

#### CLASSIFICATION TESTS FOR NATIVE LABOUR

The demand for the introduction of classification tests for native labour in industry continues. During the year, the tests were introduced at a coal mine, in the building trade, and in a clothing factory. Tests were also applied to a cross-section of the native labour employed by the Johannesburg Municipality to determine their usefulness as a classification device for this type of labour.

Officers responsible for the administration of the native personnel classification tests in industry are not generally professionally qualified. They therefore require a training course on the correct use of this test battery. This training has in the past been given in an ad hoc manner, but in view of the increasing demand, the Institute has now established a 6-week training course, which will in future be given twice a year. This is an essential service to render the tests developed by the Institute of practical value to Industry and to ensure that they will be properly used.

Good progress was made in the study of the factors determining job efficiency of Bantu civil servants. The way in which the latter see the requirements of their job and in which the same jobs are seen by white supervisors was clearly defined. The nature of job satisfactions and dissatisfactions was also analysed. By means of this information, the kind of personality that will best meet conflicting requirements and that will be able to withstand the various stresses involved has been outlined. Various

likheid wat hom die beste by teenstrydige vereistes sal aanpas en wat die verskillende soorte spanning waarmee dit gepaard gaan, sal kan weerstaan, vasgestel. Proefnemings is met verskeie toetse gedoen om te bepaal in watter mate hulle hierdie bepaalde tipe persoonlikheidsamestelling kan opspoor. Vanweë die belangrikheid van taalvaardigheid by die werkverrigting van Bantoeamptenare, is twee nuwe taalvaardigheidstoetse spesiaal uitgewerk om aan te pas by die onderwyspeil van naturelle wat vir klerklike betrekkings in die Departement van Naturellesake in aanmerking kom.

#### **PERSONEELNAVORSING BUITE DIE UNIE**

Die Instituut ontvang dikwels versoeke om hulp by die opstel van keuringsmetodes vir naturellearbeid buite die Unie. Ook is versoeke om toestemming om die toetse vir die klassifisering van naturellearbeid te gebruik uit die Federasie en van die Weskus ontvang. Daar is 'n ooreenkoms met die Rhodes-Livingstone-Instituut getref waarvolgens navrae uit Noord-Rhodesië deur hulle behandel sal word. Namens hulle is 'n personeel-psigoloog uitgesoek om hierdie aspek van die werk te behartig en dié persoon ontvang op die oomblik by die Instituut opleiding in aanlegtoetsmetodes. In Kenia is in die Departement van Gevangenisreeds 'n rukkie 'n personeelkeuringseenheid in werking. Die beampies aan die hoof van die eenheid is in die N.I.P.N. opgelei. Hierdie eenheid het sy werksaamhede tot die nywerheid uitgebrei en die Ministerie van Onderwys, Arbeid en Lande oorweeg dit om dit 'n permanente instelling te maak. 'n Beampite van die N.I.P.N. het Nairobi besoek vir samesprekings oor die manier waarop die eenheid behoort te funksioneer en watter personeel hy behoort te hê.

In Nigerië is 'n internasionale onderneming van plan om die naturelle-klassifiseringstoets vir nuwe nywerheidsontwikkelings te gebruik. In hierdie geval sal die Sielkundedepartement van die Universiteitskollege van Ghana wat gemagtig is om ons toetse te gebruik, die projek ter plaatse lei. Die Departement van Federale Opnames in Salisbury het om hulp gevra by die uitwerk van toetse vir naturelleklerke wat gebruik word om kaarte te maak. 'n Eksperimentele toetsbattery is opgestel en 'n lid van die Departement is opgelei in toetsadministrasie. Navorsingsgegevens van die eerste proefinstelling van die toetse is teruggestuur ten einde hul nuttigheid te bepaal. Uit Noord-Rhodesië is 'n versoek ontvang om raad in verband met 'n opname van indiensnemingsvoorwaardes vir blanke personeel in sekere nywerheidsondernemings. Die eerste stadium van hierdie projek is voltooi met die hulp van ons statistiek- en sosiologiesedepartemente en verdere navorsing volgende jaar word beoog.

#### **WERKVERRIGTINGS- EN WERKSTUDIES**

Hierdie opskrif dek die navorsing wat onderneem is om die aard van personeelprobleme in enige organisasie

experimental tests were tried out to determine their capacity to detect this particular type of personality make-up. In view of the importance of linguistic ability in the job performance of Bantu civil servants, two new language achievement tests were specifically designed to meet the level of education of natives eligible for clerical posts in the Native Affairs Department.

#### **PERSONNEL RESEARCH OUTSIDE THE UNION**

The Institute is frequently called upon to assist with the establishment of selection procedures for native labour outside the Union. Further requests for permission to use the native labour classification tests were received from the Federation and from the West Coast. An arrangement has been arrived at with the Rhodes-Livingstone Institute whereby enquiries from Northern Rhodesia would be dealt with by them. On their behalf a personnel psychologist was selected to take care of this aspect of the work and is at present being trained at the Institute in aptitude testing techniques. In Kenya, a personnel selection unit has been running for some time in the Department of Prisons, the officers in charge having been trained in the N.I.P.R. This unit has extended its sphere of activities into industry, and the Ministry of Education, Labour and Lands is contemplating establishing it on a permanent basis. An officer of the N.I.P.R. has visited Nairobi for consultation on the manner in which this unit should function and how it should be staffed.

In Nigeria, an international concern intends to use the Native classification test for new industrial developments. In this instance, the Department of Psychology at the University College of Ghana, which has been authorised to use our tests, will guide the project on the spot. The Department of Federal Surveys in Salisbury asked for assistance in the construction of tests for Native scribes employed on map-making. An experimental test battery was established and a member of the Department was trained in test administration. Research data from the first experimental introduction of the tests was sent back in order to evaluate their usefulness. From Northern Rhodesia came a request to advise on a survey of conditions of employment for European personnel in certain industrial enterprises. The first stage of this project was completed with assistance from our statistical and sociological departments and further research during the coming year is envisaged.

#### **OPERATIONAL AND WORK STUDIES**

This heading covers the investigation undertaken to determine the nature of personnel problems in any



en die manier waarop hulle die beste aangepak kan word, te bepaal. Dit dek ook die organisasie en meting van werk, die ontleding van werk om die daarby betrokke bekwaamhede te bepaal, en die waardering van die take na gelang van die eise wat hulle aan werkers stel. Sodanige waardering kan 'n sistematiese grondslag vir taakgradering vorm.

### **Taakbeskrywing en Taakontleding**

Min sistematiese navorsing is tot dusver gedoen in verband met die tegnieke vir taakbeskrywing wat 'n belangrike rol in die uitwerk van aanlegtoetse, opleidingsmetodes, bemannings- en taakwaarderingsprosedures speel. Daar is 'n begin gemaak om hierdie onderwerp te ondersoek. Stappe is ook gedoen om die take deur naturelle in die Unie uitgevoer te beskryf en al die werk deur hulle gedoen te ontlee. Die doel van hierdie ondersoek is om te trag om 'n klassifikasietoets vir naturelle arbeid op te stel wat vir alle doeleindes gebruik kan word. Altyd wanneer 'n navraag van die nywerheid ontvang word in verband met die gebruik van die toetse, is dit eers nodig om die take deur naturelle in die bepaalde nywerheid gedoen, te ontlee, die arbeid volgens hierdie ontledings in kategorieë in te deel, 'n uitgebreide reeks toetse op 'n eksperimentele basis op hierdie kategorieë uit te voer, dié uit te soek wat skynbaar tussen kategorieë diskrimineer, en om hierdies daarna statisties tot 'n battery te verenig en keuringstandaarde vas te stel. Hierdie prosedure is bewerklik, kosbaar en tydrowend. Die idee is nou om take deur naturelle uitgevoer in hul essensiële elemente op te breek en te bepaal watter toetse hierdie elemente ontlee. Elk van hierdie toetse sou dan gestandaardiseer word op 'n verteenwoordigende proefgroep arbeiders wat werk doen waarby die een of ander van hierdie elemente betrokke is. In die geval van nuwe navrae deur nywerhede waar die toetse nog nie gebruik word nie, sou 'n oppervlakkige taakontleding onmiddellik aantoon watter gestandaardiseerde toetse nodig sou wees en sou dit net nodig wees om klassifikasiestandaarde by die kwaliteit en beskikbaarheid van plaaslike arbeid aan te pas. Hierdie projek sal dus die praktiese bruikbaarheid van die toetse vir die klassifikasie van naturelle arbeid verhoog.

### **Bekwaamheid van Naturelle arbeid**

Die opname vir die Johannesburgse munisipaliteit onderneem, is voltooi. Dit het geblyk dat groter doeltreffendheid en ekonomie by die gebruik van naturelle arbeid verkry sou kan word deur die werk deur naturelle gedoen, opnuut te ontlee; deur arbeidskwotas opnuut by hierdie werk aan te pas; deur bemanningsprosedures in te stel; deur opleiding in toesighouding vir sowel blanke as naturellesighouers; deur die gebruik van keuringstoetse vir sekere soorte arbeid; en deur sekere diensvoorwaardes, met inbegrip van lone, te verbeter. Verdere ondersoek na die toepassing van sommige van

organization and the manner in which they can best be approached. It also covers the organization and measurement of work, the analysis of work to determine the abilities that are involved, and the evaluation of jobs according to the demands they make on the workers. Such evaluation can provide a systematic basis for job grading.

### **Job Description and Job Analysis**

Little systematic research has so far been carried out on the techniques of job description, which plays an important role in the development of aptitude tests, training methods, manning and job evaluation procedures. Work has been started on an exploration of this subject. Steps have also been taken to carry out a job description and analysis of all work on which native labour is employed in the Union. The purpose of this investigation is to attempt the establishment of an all-purpose classification test for Native labour. Whenever an enquiry is received from industry for the use of the tests, it is first necessary to carry out an analysis of the jobs performed by natives in that industry, to classify their labour into categories according to this analysis, to apply an extensive series of tests to these categories on an experimental basis, to select those that appear to be discriminating between categories, and thereafter to combine these statistically into a battery and to set selection standards. This procedure is elaborate, costly and time-consuming. The intention is now to break down jobs done by Natives into their essential elements, and to determine which tests measure these elements. Each of these tests would be standardized on a representative sample of labour performing tasks in which one or other element was involved. In the case of new enquiries from industries where the tests are not yet in use, a superficial job analysis would immediately indicate which standardized tests would be needed and it would only be necessary to adjust classification standards to the quality and availability of local labour. This project will therefore greatly enhance the practical usefulness of the Native labour classification tests.

### **Native Labour Efficiency**

The survey undertaken for the Johannesburg Municipality was completed. It was found that gains in efficiency and economics in the use of Native labour could be effected by a re-analysis of duties on which Natives were employed, by a readjustment of labour quotas to these duties, by the introduction of manning procedures, by training in supervision of both white and Native supervisors, by the use of selection tests for certain categories of labour, and by improvement of various conditions of service including wages. Proposals were made for further research into the application of some of these

hierdie prosedures is voorgestel. Daar is aanbeveel dat voor sodanige navorsing eers 'n sentrale personeelbestuursapparaat ingestel moet word. Die hooftrekke van hierdie aanbevelings is deur die Raad aanvaar en 'n nuwe kontrak is vir nog 'n jaar se navorsing gesluit.

#### Taakwaardering

In die jongste tyd is die resultate van 'n tak van wiskunde bekend as Lineêre Programopstelling met 'n sekere mate van sukses op taakwaarderingstudies toegepas. Lineêre Programopstelling skyn 'n objektiewe metode te verskaf om die relatiewe gewigte vas te stel wat aan die faktore toegeken moet word wat 'n deel van die bepaling van loontariewe en salarisskale behoort uit te maak. Die oorspronklike toepassing het in die Verenigde State van Amerika plaasgevind en 'n herhalingsstudie is onlangs deur die N.I.P.N. begin met gebruikmaking van materiaal wat van vorige taakwaarderingstudies deur die Instituut uitgevoer, beskikbaar was.

#### ERGONOMIE

Navorsing in verband met die faktore wat individuele werkverrigting beïnvloed, word gedoen in samewerking met die Laboratorium vir Toegepaste Fisiologie van die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese. Spesifieke probleme wat ondersoek word, is die invloed van warmte op die verrigting van liggaamlike take en die rol wat fisiese arbeidsvermoë en motivering onderskeidelik in die verrigting van sulke take speel. Dit was moeilik om toestande in werklike arbeidsituasies voldoende te beheer om 'n betekenisvolle skatting van die werklewering per individu te kan maak en om die invloed van die talryke faktore wat 'n rol speel, te skei. Die stadium is tans bereik waarin 'n aantal werktake beskikbaar is waaraan individue met 'n bekende fisiese vermoë standaard- en meetbare werkeenhede kan verrig in toestande wat eksperimenteel beheer kan word. Verskille in werklewering kan dan afsonderlik vergelyk word met veranderinge in omgewingstoestande, in werkbelasting, of met individuele variasies in motivering. As hierdie tegnieke eenmaal volledig uitgewerk is, sal dit moontlik wees om 'n aanvang te maak met die meting van die invloed van klimaat op menslike werkverrigting.

#### BEROEPSMOTIVERING

Dit is van belang vir 'n bestuur om kennis te dra van die faktore wat die moreel van hul werksmag beïnvloed. Houdingsstudies kan dus 'n belangrike rol speel by wat deur koöperatiewe inspanning bereik word. Een so 'n studie is aan die gang in 'n groot nywerheidsonderneming met die spesifieke doel om te bepaal in watter mate die omgewing waarin gewerk word, die loon, ander voordele, geriewe, bestuurspraktyk, en maatskaplik-ekonomiese faktore wat buite die werksituasie funksioneer, afwesig-

prosedures. It was recommended that prior to such research, central personnel management machinery should be established. The essentials of these recommendations were accepted by the Municipal Council and a new contract concluded for a further year's research.

#### Job Evaluation

Recently the results of a branch of mathematics known as Linear Programming have, with a certain measure of success, been applied to job evaluation studies. Linear Programming appears to provide an objective method of arriving at the relative weights to be assigned to the factors that should enter into the determination of pay rates and salary scales. The original application was made in the U.S.A., and a repeat study was recently initiated by the N.I.P.R., using material available from previous job evaluation studies carried out by the Institute.

#### ERGONOMICS

Research into the factors that influence individual work performance is being carried out in collaboration with the Applied Physiology Laboratory of the Transvaal and Orange Free State Chamber of Mines. Specific problems being investigated are the effect of heat on the performance of physical tasks and the contribution of physical work capacity and motivation respectively on the performance of such tasks. It has been found difficult to control conditions in actual work situations sufficiently to obtain meaningful assessments of output per individual and to separate out the influences of the many factors that are operative. The stage has been reached where a number of work tasks is available on which individuals with known physical capacity can perform standard and measureable units of work under conditions which can be experimentally controlled. Differences in work output can be referred separately to changes in the environmental conditions, in work load, or to individual variations in motivation. Once these techniques have been fully developed it will be possible to begin measuring the effects of climate on human work performance.

#### OCCUPATIONAL MOTIVATION

It is important for management to know about factors that influence the morale of their working force. Attitude studies can therefore play an important role in the achievement of co-operative effort. One such study is in progress in a large industrial undertaking, with the specific object of determining to what extent the working environment, pay, other benefits, amenities, managerial practices, and socio-economic factors operative outside the work situation, can influence absenteeism, which is a major



heid van die werk kan beïnvloed wat 'n belangrike simptome van swak werktoestande is. Die invloed van hierdie faktore word beoordeel deur middel van onderhoud wat 'n sorgvuldig voorbereide rooster volg en deur middel van 'n persoonlikheids-toets. Uit voorlopige resultate blyk dat diegene wat dikwels afwesig is, ook geneig is om 'n vyandige houding teenoor diensttoestande in te neem, hoewel die bevindings meer ingewikkeld gemaak word deur leeftydsverskille tussen die onder-vraagdes. Jonger werksmense is meer dikwels afwesig en is minder tevrede met hul status, loon, vooruitsigte en metodes van bestuur en toesighouding. Die moontlikheid om toekomstige gedrag wat afwesigheid betref uit hierdie data te voorspel en om maatreëls te neem om die toestand te verhelp, is die volgende wat ondersoek moet word.

### AANSPORINGS

In verlede jaar se verslag is melding gemaak van 'n studie deur middel van 'n vraelys van die gebruik van aansporingskemas in die nywerheid en die omstandighede waaronder sulke skemas ingevoer is. Die materiaal is nou finaal ontleed. Die totale aantal vraelyste (6,429) wat ingestuur is, is tot 3,973 verminder deur firmas uit te sluit wat nie werklik goedere vervaardig nie. In die geheel het 2,001, of 50.3 persent, produserende firmas die vraelyste beantwoord. Van hierdie groep het 316, of 15.8 persent, 'n aansporingskema gehad; 77, of 3.8 persent, het hul aansporingskema gestaak; 179, of 8.9 persent, was voornemens om aansporingskemas in te stel; en 1,429, of 71.4 persent, was nie van plan om dit te doen nie. Dit het onmoontlik geblyk om hierdie opgawes volgens tipe nywerheid of streek te ontleed aangesien die getal in elke onderklas te klein en nie verteenwoordigend genoeg was om veralgemening te regverdig nie. 'n Onderzoek is tans aan die gang om die reaksie van individuele werkers op aansporingslone te bepaal en om vas te stel watter uitwerking hierdie reaksies op produksie het.

### MANNEKRAGOPNAME

Die tweede stadium in die mannekragopname wat bestaan het in die uitvoering van bekwaamheidstoets op 'n verteenwoordigende steekproef van diegene wat die vraelys oor onderwyspeil en beroepsaspirasies beantwoord het, is voltooi: 5,500 mans is getoets. Daar is sorgvuldig nagegaan hoe verteenwoordigend hierdie groep was; dit was nogal 'n ingewikkelde taak vanweë die feit dat dit moeilik was om diegene wat nie vir opleiding in die Aktiewe Burgermag opgeroep was nie, op te spoor en hul samewerking te verkry. Daar sal onthou word dat die basis van hierdie mannekragopname die manlike blanke bevolking van 18- tot 19-jarige leeftyd was volgens die loting vir opleiding in die Aktiewe Burgermag geneem.

symptom of poor work condition. The influence of these factors is assessed by means of interviews following a carefully prepared schedule and by means of a personality test. Preliminary results indicate that those with a poor attendance record also tend to adverse attitudes to conditions of service, though the findings are complicated by age differences between informants. Younger operatives have a poorer attendance record and are also less satisfied with status, pay, prospects, and managerial or supervisory practices. The possibility of predicting future absence behaviour from these data, and of taking remedial measures, will next be investigated.

### INCENTIVES

In last year's report, reference was made to a questionnaire study of the use of incentive schemes by industry, and the circumstances under which such schemes were introduced. The material has now been finally analysed. The total number of 6,429 questionnaires sent out was reduced to 3,973 by the exclusion of firms not actually manufacturing goods. A total number of 2,001, or 50.3 per cent of producing firms, responded to the questionnaire. Of this group, 316, or 15.8 per cent, had an incentive scheme; 77, or 3.8 per cent had discontinued incentives; 179, or 8.9 per cent intended to introduce an incentive scheme; and 1,429, or 71.4 per cent had no intention of doing so. It was not found possible to analyse these returns by type of industry or region, as the numbers in each sub-class were too small and too unrepresentative to warrant generalization. An investigation is now in progress to determine the reactions of individual workers to wage incentives, and on the effect of these reactions on production.

### MANPOWER SURVEY

The second stage in the manpower survey, which consisted of the application of ability tests to a representative sample of those who had completed the questionnaire on educational status and occupational intentions, has been completed: 5,500 men were tested. The representative nature of this group was carefully tested, a task of some complexity in view of the fact that it was difficult to trace, or to get the co-operation of, those not actually called up for training in the Active Citizen Force. It will be remembered that the basis of this manpower survey was the European male population at the 18 to 19 year age-level as sampled by means of the ballot for Active Citizen Force training.

## SOSIOLOGIESE STUDIES

Taakmotivering en die mate van bevrediging wat die individu uit sy werk kry of die ontevredenheid wat dit by hom verwek, word per slot van rekening deur sy aspirasies bepaal wat op hul beurt weer afhang van sy plek in die gemeenskap, sy sosiale verlede, en sy groepsverband—kortom, sy lewenswyse. Om die talryke maatskaplike probleme, met inbegrip van dié in verband met arbeidsdoeltreffendheid, te kan begryp, is dit nodig om gegewens te hê van die afkoms, die maatskaplik-ekonomiese agtergrond, die behoeftes en ideale van verskillende lae van ons maatskappy, blank sowel as nie-blank. Een so 'n studie is gedurende die jaar op personelede van die Wetenskaplike en Nywerheidsnavorsingsraad uitgevoer. Die doel was om vir hierdie tipe bevolking 'n besoldigingspeil vas te stel wat vir hul lewenswyse en aspirasies geskik is. Die versamelde gegewens is vergelyk met dié vir ander seksies van die gemeenskap en ander beroepe wat deur die Departement van Sensus en Statistiek versamel is vir hul ondersoek na lewensduurte.

### Maatskaplike Opnames van Behuisingsbehoefte

Om die Nasionale Bounavorsingsinstituut en, deur hulle, die Nasionale Behuisingskommissie by die beplanning van huise vir blankes te help, is 'n opname gedoen van die behoefte aan huise van 'n bepaalde prys vir blankes, gebaseer op die opname van gesinsuitgawes wat in November 1955 deur die Buro vir Sensus en Statistiek gedoen is. Die behuisingsopname het huishouers gedek met 'n geskatte inkomste van £25 tot £35 per maand. Inkomste in verhouding tot gesinsgrootte is bepaal en 'n klassifikasie is van die gesinstipes wat onder hierdie inkomstegroep val, opgestel. Die ontleding is as basis gebruik om die behoefte aan huise van 'n bepaalde tipe, grootte en prys, en die dele van die land waar hierdie huise gebou sou moet word, te bepaal. By hierdie studie is ongeveer 3,000 lyste omtrent gesinne in 32 stedelike gebiede gebruik. By die berekening van die uitgangspeil vir armoedebepaling en oorbevolkingsindekse is nie minder as 15,000 ponskaarte gebruik nie.

Daar is ook gewerk aan die voltooiing van die maatskaplik-ekonomiese opnames van Bantogemeenskappe in Kaapstad, Port Elizabeth, Durban, Vereeniging en Germiston, wat oorspronklik onderneem is vir die beplanning van naturellebehuising en -gemeenskapsontwikkeling. Taamlik belangrike navorsing in verband met die maatskaplike probleme wat uit die verstedeliking van dele van die naturellebevolking van die Unie voortspuit, is deur hierdie opnames moontlik gemaak. Hierdie soort inligting is basies, nie alleen vir behuisingsvraagstukke nie maar ook vir nywerheidspersoneelprobleme in verband met houding teenoor werk, arbeidsomset en produktiwiteit.

## SOCIOLOGICAL STUDIES

Job motivations and the satisfactions or dissatisfactions which the individual derives from his work are ultimately determined by his aspirations, which in turn depend on his place in the community, his social antecedents, and his group relations—in short, his way of life. It is necessary to have facts concerning the origins, the socio-economic background, the wants and ideals of various sections of our community, both Black and White, for an understanding of many social problems, including those relating to work efficiency. One such study was carried out during the year on staff-members of the C.S.I.R. Its purpose was to assess for this type of population, a level of remuneration appropriate to their way of life and aspirations. Comparisons were made with other sections of the community, and other professions, in terms of data collected by the Department of Census and Statistics for their cost of living enquiry.

### Social Surveys of Housing Requirements

To assist the National Building Research Institute and through them, the National Housing Commission, in the planning of European housing, a survey of the need for European housing of a particular cost was carried out, based on the survey of family expenditures carried out by the Bureau of Census and Statistics in November, 1955. The housing survey covered households with an estimated income of from £25 to £35 p.m. Income in relation to family size was determined and a classification was made of the types of families to be found in this income range. The analysis was used as a basis for assessing the need for houses of a particular type, size and cost, and the parts of the country in which these houses would have to be erected. The study involved approximately 3,000 schedules from families in 32 urban areas. In the calculation of poverty datum lines and indices of overcrowding, no less than 15,000 punch cards were used.

Work was also done on the completion of the socio-economic surveys of Bantu Communities at Cape Town, Port Elizabeth, Durban, Vereeniging and Germiston which were originally undertaken for the planning of native housing and community development. Research of some importance into the social problems arising from the urbanization of sections of the native population of the Union was made possible by means of these surveys. Information of this kind is basic not only for housing questions but also for industrial personnel problems relating to job attitudes, labour turnover, and productivity.



### Rondtrekkende Arbeid

Daar is 'n begin gemaak met die faktore wat die bewegings van rondtrekkende arbeiders bepaal. Die doel van hierdie studie was om die maatskaplik-ekonomiese en die motiveringsfaktore te ondersoek wat 'n arbeider daartoe dryf om werk buite sy eie plattelandse gebied te soek, en watter invloed die duur en frekwensie van sy afwesigheidstydperke bepaal. Die onderskeie rolle deur faktore binne die werkkring en binne die plattelandse dorpsgemeenskappe en die stamlewe gespeel, word afsonderlik bepaal.

### Die Maatskaplike Agtergrond van Blanke Werkersgroepe

Om 'n beter begrip van die taakvereistes en motiverings van blanke werkers te kan vorm, is 'n stelselmatige studie gemaak van die sosiale agtergrond, lewenswyse en die houding van verskillende werkersgroepe. Twee sulke groepe is reeds bestudeer: die een werksaam in die staalbedryf en die ander in die mynbedryf.

### EKSPERIMENTELE LANGTERMYNNAVORSINGSPROJEKTE

Hierdie projekte omvat sowel algemene psigologiese probleme wat betrekking op personeelwerk het (ondersoek in verband met die aard van bekwaamhede, persoonlikheidsontwikkeling, die verstandelike groei by naturellekinders); maatskaplik-psigologiese probleme (soos byvoorbeeld faktore wat groepsverhoudings beïnvloed, die uitwerking van beskawing op die ontwikkeling van bekwaamhede); as tegnieke (soos byvoorbeeld psigometriese metodes, statistiese hulpmiddele vir die ontleding van gegewens).

#### Elektrofisiologie

Die eksperimentele studies in die Departement Psigofisiologie het nog steeds grotendeels ten doel gehad om die verband tussen elektrofisiologiese verskynsels, temperament en waarneming vas te stel. Studies in verband met faktore wat die E.E.G. beïnvloed is ook aangepak. Twee projekte met meer onmiddellik praktiese toepassings kan genoem word. 'n Studie is gemaak van die verhouding tussen die E.E.G. en kwashiorkor, 'n proteïengebreksiekte wat baie onder naturellekinders voorkom. Dit het geblyk dat onder 'n groep pasiënte wat aan die siekte gely het, 38 persent van die rekords abnormaal was in vergelyking met 3 persent van 'n kontrolegroep. Abnormaliteite van die slaaplobbe was baie opvallend wat daarop dui dat hierdie deel van die brein besonder kwesbaar vir die uitwerking van dié siekte is. Of hierdie uitwerking blywend is en in watter mate dit die groei bepaal van die verstandelike vermoë by diegene wat van die siekte herstel, moet nog vasgestel word.

Die baie interessante waarneming is gedoen dat daar

### Migratory Labour

A study of the factors determining the movements of migratory labourers was started. The object of this study was to investigate the socio-economic and motivational factors that induce a labourer to seek work outside his own rural area, and what influences condition the duration and frequency of his absences. The parts played by factors within the work situation and within the rural village communities and tribal life are being separately determined.

### The Social Background of White Operative Groups

To gain a better understanding of the job requirements and motivations of white operatives, systematic studies were undertaken of antecedents, ways of living, and attitudes of different types of operative groups. Two such groups have already been studied, one employed in the steel, the other in the mining industry.

### LONG TERM EXPERIMENTAL RESEARCH PROJECTS

These projects are undertaken both on general psychological problems with a bearing on personnel work (studies on the nature of abilities, personality development, the growth of intelligence in native children); on social psychological problems (such as factors influencing group relations, the effect of culture on the development of abilities); and on techniques (such as psychometric methods, statistical devices for analysis of data).

#### Electrophysiology

The experimental studies in the Psychophysiology Department continued to be directed largely to the relationship between electrophysiology phenomena, temperament and perception. Studies on factors influencing the E.E.G. were also undertaken. Two projects with more immediately practical applications can be mentioned. A study was made of the relationship between the E.E.G. and kwashiorkor, a protein deficiency disease which is common in native children. It was found that in a group of patients suffering from this disease, 38 per cent of the records were abnormal as compared with 3 per cent in a control group. Temporal lobe abnormalities were most prominent, which indicates that this part of the brain appears to be particularly vulnerable to the effects of the disease. Whether these effects are permanent, and to what extent they determine the growth of intellectual abilities in those who recover from the disease remains to be determined.

The highly interesting observation has been made that there is some connection between the E.E.G. and per-

'n sekere verband bestaan tussen die E.E.G. en prestasie by die Wechsler-onderzoek van die verstand van volwassenes. By hierdie onderzoek kan die prestasie onderverdeel word in visueel-konkrete, verbaal-abstrakte en temperamentele komponente, tesame met 'n leeftydskomponente. Die eerste drie omvat almal elektro-fisiologiese elemente wat niks met intelligensie te doen het nie. Hierdie verband is nog nooit vantevore waargeneem nie. Dit bevestig dat die I.K. 'n ooreenvoudige weergawe van die resultaat van 'n intelligensietoetsprestasie is. Dit skyn dat sodanige toetse heelwat meer bepaal as net verstandelike vermoë, 'n punt waarop vroeër reeds nadruk gelê is by die Wechsler-toets dog waaraan tans 'n interessante en nuwe eksperimentele grondslag verleen word.

### **Persoonlikheidsstudies**

Die Pauli-toets in verband met werklewering en uithou-vermoë waaromtrent vroeër verslag gedoen is dat dit in sekere mate in verband staan met resultate by universitêre studies behaal, is verder ondersoek. Dit het geblyk dat prestasie by die toets bestendig is en dat proefpersone na tussenpose van 6 tot 13 maande geneig is om hul vorige prestasies in groot mate te herhaal. Daar is vasgestel dat terwyl prestasie by intelligensietoetse geen verband hou met punte by universiteitseksamens behaal nie, verskeie Pauli-toetsmetings wel beduidende korrelasie toon. Verdere aanduidings is verkry dat diegene met 'n hoë I.K. maar lae eksamenresultate geneig is om lae punte by die snelheids-, noukeurigheds- en uithou-vermoë-aspekte van die toetse te behaal.

### **Voeding en Verstandelike Ontwikkeling**

Die verdere opstelling van toetse en vasstelling van norme vir verstandelike en liggaamlike ontwikkeling by natuurlike kinders is stopgesit vanweë vertraging in die oprigting van 'n gebou naby die Munisipale Kliniek in Orlando waar langtermynstudies wat dieetkundige, sosiologiese, mediese en psigologiese waarnemings vereis, uitgevoer sou word. Ondertussen is taamlik geslaagde proefnemings met rotte gedoen. Na heelwat moeilikhede het dit moontlik geblyk om 'n generasie rotte te teel wat uit moeders gebore is wat aan proteïengebrek ly en wat self grootgemaak is op 'n dieet waarin proteïen kortkom. Die prestasie van hierdie diere by die aanleer van toetse was beslis laer as dié van normale kontrolediere. Dit is die eerste maal dat so 'n uitwerking aangetoon is. In die literatuur oor die onderwerp word geen melding gemaak dat dergelike proewe elders met sukses uitgevoer is nie. Die implikasies van hierdie bevinding sal nog verder ondersoek moet word. Daar word getrag om 'n tweede generasie te teel, waarby sowel die aanstaande moeders as die kleintjies op dieselfde gebrekkige dieet gehou word. Die vraag sal wees of die uitwerking kumulatief is en of dit omgekeer kan word deur die dieet weer tot die normale terug te bring.

formance on the Wechsler test of adult intelligence. Performance on this test can be broken down into visual-concrete, verbal-abstract, and temperamental components, together with an age factor. The first three all involve non-intellective electro-physiological elements. This relationship has not been previously observed. It confirms that the I.Q. is an oversimplified rendering of the result of an intelligence test performance. Such tests would appear to be measuring a good deal more than mental ability, a point that has previously been stressed with regard to the Wechsler test, but which is now being given an interesting and new experimental foundation.

### **Personality Studies**

The Pauli test of work output and staying power, which was previously reported to have some bearing on achievement in University studies, has been subjected to further research. It has been shown that performance on the test is stable and that after intervals of from 6 to 13 months, subjects tend substantially to repeat their previous performances. It was confirmed that whereas intelligence test performance shows no relationship with marks in University examinations, various Pauli test measures do show significant correlations. Further indications were obtained that those with high I.Q.'s but low examination achievements tend to score poorly in the speed, accuracy and staying power aspects of the tests.

### **Nutrition and Mental Development**

The further construction of tests and the compilation of norms for mental and physical development in Native babies was halted as a result of delays in the erection of a building in proximity to the Municipal Clinic at Orlando where long-term studies involving dietetic, sociological, medical and psychological observations were to be carried out. Meanwhile some success was achieved in nutritional experiments with rats. After considerable difficulties it was found possible to raise a generation of rats which were born from protein deficient mothers and who were themselves reared to maturity on a protein deficient diet. The performance of these animals on learning tests was distinctly inferior to that of normal controls. This is the first time that such an effect has been demonstrated. There is no evidence from the literature on the subject that similar experiments have been successfully performed elsewhere. The implications of this finding need to be further investigated. Attempts are being made to raise a second generation, maintaining both prospective mothers and offspring on the same deficient diet. The question will be put whether the effects are cumulative and whether they can be reversed by restoring the diet to normal.



### **Bestudering van die Waarnemingsvermoë van Naturelle**

Verskillende ondersoek is uitgevoer in verband met die invloed van ondervinding op die waarneming van prentemateriaal deur naturelle. Ander aspekte van waarneming, soos byvoorbeeld die vatbaarheid vir visuele illusies, patroonwaarneming en perseptuele denke is ook bestudeer. Verskille in die waarnemingsvermoë van blankes en naturelle is voortdurend waargeneem, en dit is van aansienlike teoretiese en praktiese belang dat die aard van hierdie verskille deeglik ondersoek word.

### **Wiskundige Statistiek en Psigometrie**

Heelwat werk is gedoen in verband met nuwe meet- inrigtings en ontledingstegnieke. Van besondere belang is die vasstelling van 'n nuwe maatstaaf vir die keuse van veranderlikes vir 'n regressievergelyking, die afleiding van parameters van psigomotoriese leerkurwes, studies in verband met die teorie van faktorontleding en toetse met betrekking tot die oorvleueling van meervariante normale bevolkings.

### **SPESIALE PROBLEME**

#### **Betreklike Voordele van Verskillende Desimale Muntstelsels**

Op versoek van die Kommissie in verband met die Desimale Muntstelsel is verskillende tiendelige muntstelsels ondersoek om die gemak vas te stel waarmee een geldstelsel gedurende die oorgangstyd tot 'n ander herlei kan word. Daar is veral aandag geskenk aan die moeite wat deur minder ontwikkelde of ongeletterde nie-blankes ondervind sou word. Spesiale toetse moes vir hierdie groep ontwerp word.

#### **Motorfietsongelukke**

Die ondersoek in verband met die omstandighede waaronder motorfietsongelukke plaasgevind het, is voltooi. Verslae is opgestel waarin faktore wat tot die gebeur van motorfietsongelukke bygedra het, ontleed is. Maatreëls waardeur motorfietsryers beskerm, en die aantal ongelukke verminder sou kan word, is bespreek.

#### **Die Invloed van Bilharzia op Aktiwiteit**

'n Geringe mate van hulp is aan die Bilharziana-vorsingsseenheid verleen by die bestudering van die invloed van bilharzia op die aktiwiteitspeil van muis. 'n Nuwe tipe aktiwiteits-kou is ontwerp en gemaak, waarin die aktiwiteitspeil van muis en rotte oor lang tydperke geregistreer kan word, terwyl dié op natuurlike wyse in 'n betreklik normale omgewing beweeg. Daar is geen verskil gevind tussen die algemene aktiwiteitspeil van besmette en onbesmette muis nie, maar die besmette muis het neiging getoon om teen die einde van die proeftyd minder aktief te word.

### **Perceptual Studies of Natives**

Various investigations have been conducted on the influence of experience on the perception of pictorial material on the part of Natives. Other aspects of perception such as the susceptibility to visual illusions, pattern perception, and perceptual thinking, have also been studied. Differences in perceptual ability between Europeans and Natives have persistently been observed, and it is of considerable theoretical and practical importance that the nature of these differences should be fully investigated.

### **Mathematical Statistics and Psychometrics**

A considerable volume of work has been done on the development of new measuring devices and analytical techniques. Of particular note are the establishment of a new criterion for the selection of variables for a regression equation, the derivation of parameters of psychomotor learning curves, studies in the theory of factor analysis and tests connected with the overlap of multivariate normal populations.

### **SPECIAL PROBLEMS**

#### **Relative Merits of Alternate Systems of Decimal Coinage**

On behalf of the Decimal Coinage Commission alternate systems of decimal coinage were examined for ease with which conversions from one money system to another could be made during the transition stage. Particular attention was paid to the difficulties that would be experienced by poorly educated or illiterate non-Europeans. Special tests had to be designed for this group.

#### **Motor Cycle Accidents**

The investigations concerning the circumstances under which motor-cycles accidents occurred were completed. Reports were prepared in which factors contributing to the occurrence of motor-cycle accidents were analysed. Measures whereby the motor-cyclists could be safeguarded and the accident rate could be reduced were discussed.

#### **Effects of Bilharzia on Activity**

Some assistance was given to the C.S.I.R.'s Bilharzia Natural History Unit in the study of the effect of bilharzia on the activity level of mice. A new type of activity cage was designed and built, in which the activity level of mice and rats can be recorded for long periods whilst the animals move naturally in a relatively normal environment. No difference was found between the general activity level of infected and non-infected mice, but there was a tendency for infected mice to reduce activity towards the end of the experimental periods.

# Nasionale Voedingnavorsingsinstituut

*Direkteur:* DR. F. W. QUASS

Die verskillende afdelings van die Instituut is merendeels reeds goed toegerus met wetenskaplike apparaat; die aanvulling van gebreke wat nog bestaan, word aan bande gelê deur 'n nypende tekort aan ruimte in die huidige huisvesting. Hierdie werkruimteprobleem sal egter na verwagting in die komende jaar opgelos word wanneer die nuwe gebou, met die oprigting waarvan baie goeie vordering gemaak word, in gebruik geneem word.

Die nuwere afdelings van die Instituut, naamlik Proteïenchemie en Mikrobiologie, lewer reeds waardevolle bydraes tot die navorsingsprogram van die Instituut. Gedurende die jaar is die Afdeling Veldstudies ook ingestel en is 'n begin gemaak met voedingstatusopnames en veldvoedingsproewe in naturellegebiede in Wes-Transvaal en in Atteridgeville naby Pretoria. Dit word al meer duidelik dat vir die behoorlike hantering van die verskeidenheid probleme wat met die voeding van die bevolking in verband staan, baie meer uitgebreide studies nodig is om te kan vasstel welke, en in watter mate, voedingsgebreke onder die bevolking voorkom. Daar die voedselbronne en eetgewoontes van die bevolking, asook die bevolking self, so heterogeen is, is die voorkoms van voedingsgebreke in alle waarskynlikheid ook merendeels regionaal en nie noodwendig nasionaal van aard nie. 'n Opname van die heersende voedingstatus moet dus intensief op 'n streeksbasis uitgevoer word om 'n vaste grondslag te vind vir optrede ten opsigte van die voeding van die bevolking in bepaalde streke.

Die Instituut het gedurende die afgelope jaar voortgegaan om die Departement van Voeding met navorsing en analitiese dienste by te staan. Nywerhede is van navorsingsdienste en raad bedien.

Die Instituut is baie dank verskuldig aan die Departemente Voeding, Landbou, Naturellesake, Onderwys, Kuns en Wetenskap en Gesondheid, asook aan die Afdeling Naturellesake van die Stadsraad van Pretoria, vir welwillende hulp met navorsing waarmee die Instituut besig is. Om verdere samewerking op die gebied van voedselnavorsing te bevorder, is komitees in die lewe geroep waarop die Departemente Landbou en Voeding en belanghebbende Beheerrade verteenwoordig is. Soortgelyke komitees is ook gevorm waardeur hierdie Departemente en Beheerrade die Instituut behulpzaam kan wees met die opstel van Suid-Afrikaanse voedseltabelle.

Die Adviserende Komitee vir Voedingnavorsing van die W.N.N.R. het vyf keer gedurende die jaar vergader en het waardevolle raad en leiding aan die Instituut gelever.

# National Nutrition Research Institute

*Director:* DR. F. W. QUASS

Most of the Divisions of the Institute are already well equipped with scientific apparatus; filling the gaps is restricted by a serious lack of space in the present accommodation. This problem of lack of space is, however, expected to be solved next year when the new building, the erection of which is showing good progress, will be occupied.

The newer Divisions of the Institute, namely, Protein Chemistry and Microbiology, are already contributing a valuable share to the Institute's research programme. During the year under review a Division of Field Studies was established and a start was made with nutritional status surveys and field nutrition tests in Native areas in the Western Transvaal and at Atteridgeville, near Pretoria. It is becoming ever more apparent that for the proper handling of the various problems in connection with the feeding of the population, much more extensive studies will be required in order to determine what nutritional deficiencies occur among the population and to what extent they are present. Since the sources of food and the eating habits of the population, as well as

the population itself, are so heterogeneous, the incidence of nutritional deficiencies is in all probability mostly of a regional rather than of a national character. A survey of the present nutritional situation must therefore be carried out intensively on a regional basis in order to find a sound foundation for any action in connection with the feeding of the population in certain regions.

The Institute this year continued to assist the Department of Nutrition by means of research and analytical services. Research services were rendered to industries and advice given.

The Institute owes a great debt of gratitude to the Departments of Nutrition, Agriculture, Native Affairs, Education, Arts and Science, and Health, as well as to the Non-European Affairs Department of the Pretoria Municipality, for their assistance in connection with the research work being done by the Institute. In order to promote further collaboration in the field of nutrition research, committees were set up, on which the Department of Agriculture and Nutrition as well as interested Boards of Control were represented. Similar committees were also established enabling these Departments and Control Boards to assist the Institute in drawing up tables of South African foods.

The C.S.I.R.'s Advisory Committee for Nutrition Research met five times during the year and gave the Institute valuable advice and guidance.



## KWASHIORKOR

Navorsing oor hierdie gebreksiekte is voortgesit. Aandag is gegee aan die terapeutiese effek van verskillende voedsels, veral goedkoper proteïenryke voedsels.

### Kaseïen en Carobboontjemeel

Die ondersoek van die effek van 'n ingevoerde handelsmerkkaseïen en Carobboontjemeel in die dieet van kwashiorkor pasiënte op die diarree en snelheid van herstel, is afgehandel. Altesaam 92 gevalle is ondersoek en uit die resultate kon aangetoon word dat, vergeleke met ander goedkoper voedselstowwe, byvoeging van hierdie duur voedselstowwe tot die dieet nie die herstel verhaas nie. In hierdie proewe is 'n dieet toegepas wat 6.5 persent Carobboontjemeel bevat, en daar is bevind dat toediening op hierdie peil selfs absorpsie van stikstof kan belemmer.

### Melkpoeier

Die terapeutiese waardes van sproeigedroogde en van rollergedroogde afgeroomde melkpoeier in kwashiorkor, is met mekaar vergelyk. Volgens die kriteria wat gebruik is vir die beoordeling van die resultate, was die rollergedroogde produk net so doeltreffend as die duurder sproeigedroogde produk.

### Vismeelblom

Verdere toetse is met verwerkte vismeelblom uitgevoer. Die resultate wat verkry is met 'n dieet wat 40 persent vismeelblom bevat het, was teleurstellend omdat dit vir sommige pasiënte nie aanneemlik was nie. Tans word die uitwerking van 'n byvoeging van 10 persent vismeelblom by mieliepap op herstellende gevalle van kwashiorkor nagegaan.

### Faktor 3

In samewerking met dr. Klaus Schwarz van die „National Institutes of Health”, Bethesda, V.S.A., word die moontlike rol van 'n „faktor-3”-tekort in die etiologie van kwashiorkor ondersoek.

### Glisien

Die uitwerking van byvoegings van glisien by mielie-meel op kwashiorkor pasiënte is in samewerking met prof. Brock en dr. Hansen van die Universiteit van Kaapstad, uitgetoets en die resultate word tans verwerk.

### Effek van Vette op die Serumlipiede

Die effek van verskillende soorte vette in die dieet van herstellende kwashiorkor pasiënte op die serumlipiedehoude word bestudeer. Die pasiënte word vir 'n periode van ongeveer drie weke vanaf opname in die hospitaal op 'n dieet van afgeroomde melkpoeier en vitamieneghou. Daarna word groepe op die volgende diëte geplaas: volroom-melkpoeier, afgeroomde melkpoeier,

## KWASHIORKOR

Research on this deficiency disease was continued. Attention was given to the therapeutic effect of various foodstuffs, especially the cheaper ones rich in proteins.

### Casein and Carob Flour

The investigation of the effect of the presence of an imported brand of casein and carob flour in the diet of kwashiorkor patients on the diarrhoea symptoms and rate of recovery was completed. Altogether 92 cases were investigated and results revealed that in comparison with other, cheaper foodstuffs, the addition of these expensive foodstuffs to the diet does not accelerate recovery. In these tests a diet containing 6.5 per cent carob flour was used and it was found that application at this rate may even impede absorption of nitrogen.

### Powdered Milk

The therapeutic values of spray-dried and of roller-dried skim milk powder in kwashiorkor treatment were compared. According to the criteria used for the evaluation of the results, the roller-dried product was just as efficacious as the more expensive spray-dried product.

### Fish Flour

Further tests were carried out with processed fish flour. The results obtained with a diet containing 40 per cent of fish flour were disappointing as it did not agree with some of the patients. The effect of a 10 per cent addition of fish flour to mealie porridge on kwashiorkor cases on the way to recovery is at present being studied.

### Factor 3

In collaboration with Dr. Klaus Schwarz of the National Institute of Health, Bethesda, U.S.A., the possible part played by a “factor 3” deficiency in the etiology of kwashiorkor is being investigated.

### Glycine

The effect of additions of glycine to mealie porridge on kwashiorkor patients was tested in collaboration with Prof. Brock and Dr. Hansen of the University of Cape Town, and the results are now being collated.

### The Effect of Fats on the Serum Lipides

The effect of various types of fat in the diet of recovered kwashiorkor patients on the serum lipides content is being studied. The patients are kept on a diet of skim milk powder and vitamins for a period of approximately three weeks from the time they are admitted to hospital. Thereafter groups are put on the following diets: Full-cream milk powder, skim milk powder, Soyolac (a

Soyalac (’n oplosbare sojaproteïenprodukt), en afgeroomde melkpoeier met soja-olietoevoëging. Al vier die diëte is identies ten opsigte van die hoeveelheid kalorieë afkomstig van proteïene. Waar vet by diëte gevoeg word, is die hoeveelheid kalorieë afkomstig van vet ook in alle gevalle identies.

Die pasiënte se serum word met opname in die hospitaal en daarna wekklies ondersoek met betrekking tot proteïene (albumien, totale globulien, sowel as die  $\alpha$ ,  $\beta$  en  $\gamma$  globulienfraksies), totale lipiede, jodiumgetal van die lipiede, cholesterol, fosfolipiede, kalsium en fosfor. Dit blyk dat die lipiede-inhoud van die serum van pasiënte op ’n dieet van afgeroomde melkpoeier plus soja-olie veel laer is as dié van pasiënte op Soyalac of volroom-melkpoeier. Die jodiumgetal van die serumlipied van die eerste twee groepe is ook veel laer gevind as dié van die groepe wat op ’n dieet van Soyalac of afgeroomde melkpoeier plus soja-olie was.

## VOEDING EN DEGENERATIEWE HART- EN BLOEDVATSIEKTES

### Gevangenisprojek oor Dieet en Metabolisme

Afgesien van deelname in ’n adviserende hoedanigheid, berus die bydrae van die Instituut tot hierdie navorsingsprojek hoofsaaklik op die bepaling van die chemiese samestelling van die dieet. Vir hierdie doel is die daaglikse rantsone van beide die Blanke en Nie-blanke proefpersone twee keer gedurende die jaar vir periodes van 7 dae bemonster en ontleed.

### Cholesterolmetabolisme

’n Eksperiment is met rotte uitgevoer om vas te stel of organiese oksisure enige invloed op die cholesterolwaardes van die bloed het. Melksuuraanvulling van die dieet het geen effek getoon nie, terwyl sitroensuuraanvulling ’n afname in serumcholesterol veroorsaak het. Die groeivermoë van die kontrole- en eksperimentele rotte was identies. Die cholesterolinhoud van die rot se serum is baie laag ( $52 \pm 12$  mg./100 ml.). Hierdie eksperiment sal op mense herhaal word.

### Ioonaktiwiteite in die Bloed

Die fisies-chemiese eienskappe van die bloed, wat van belang mag wees in die proses van bloedstolling en die etiologie van hart- en bloedvatsiektes, word ondersoek. ’n Metode om die ioonaktiwiteite van die bloed te bepaal met behulp van ioonuitwisselende membrane is ontwikkel vir verdere toepassing in hierdie navorsingsveld.

### Mikro- en Makro-Elemente

’n Vergelykende studie is gemaak van die serumkoperinhoud van ’normale’ Blankes en ’normale’ Bantoes. Honderd sewe-en-vyftig proefpersone is ondersoek en

soluble soya protein product) and skim milk powder with an addition of soyaoil. These four diets are identical in so far as the protein calories are concerned. Where fat is added to diets, the number of fat calories is also identical in all cases.

When patients are admitted to hospital, and thereafter every week, their serum is tested for proteins (albumin, total globulin, as well as  $\alpha$ ,  $\beta$  and  $\gamma$  globulin fractions), total lipides, iodine number of the lipides, cholesterol, phospholipides, calcium and phosphorus. It appears that the lipide content of the serum of patients on a diet of skim milk powder plus soya oil is much lower than that of patients on soyalac or full-cream milk powder. The iodine number of the serum lipide of the first two groups was also found to be much lower than that of the groups kept on a diet of Soyalac or skim milk powder plus soya oil.

## NUTRITION AND DEGENERATIVE CARDIOVASCULAR DISEASES

### Prison Research Project on Diet and Metabolism

In addition to participation in an advisory capacity, the Institute’s contribution to this research project mainly consists of the determination of the chemical composition of the diet. For this purpose the daily rations of both the European and the Non-European test persons were twice sampled and analysed during the year for periods of seven days.

### Cholesterol Metabolism

An experiment was carried out with rats to determine whether organic oxy-acids have any effect on the cholesterol values of the blood. Lactic acid supplementation of the diet showed no effect, while citric acid additions caused a reduction in the serum cholesterol. The growth capacity of the control rats and the test rats was identical. The cholesterol content of the rat’s serum is very low ( $52 \pm 12$  mg./100 ml.). This experiment will be repeated on human beings.

### Ion Activities in the Blood

The physico-chemical properties of blood, which may be of importance in the process of blood coagulation and the etiology of cardiovascular diseases are being investigated. A method has been developed for determining the ion activities of blood with the aid of ion-exchanging membranes for further application in this field of research.

### Micro- and Macro-Elements

A comparative study was made of the serum copper content of “normal” Europeans and of “normal” Natives. One hundred and seventy-five test persons were examined



daar is gevind dat die serumkopergehalte van die volwasse Bantoe noemenswaardig hoër is as dié van die volwasse Blanke van dieselfde ouderdom en geslag. Daar is nog nie voldoende kinders in die twee bevolkingsgroepe ondersoek om enige afleidings te kan maak oor wat die toestand in die laer ouderdomsgroepe is nie.

## VELDVOEDINGSPROEWE

### Aanvullingsstudies

'n Begin is gemaak met voedselaanvullingsstudies in uitgesoekte Naturellestatte in Wes-Transvaal, te wete Koffykraal en Grootfontein. Die betrokke Bantoe-stamme is uitgesoek omdat hulle betreklik afgesonderd woon en 'n baie eenvoudige en primitiewe leefwyse volg; die Europese lewenspatroon staan nog taamlik op die agtergrond. Die stapelvoedsel is hoofsaaklik kafferkoring wat in 'n mate aangevul word met veldplantevoedsels wat in die omgewing gevind word.

Die studie is voorafgegaan deur 'n bepaling van die voedingstatus van kinders in die ouderdomsgroep 5-8 jaar, en 'n poging is ook aangewend om, sover moontlik, 'n dieetopname van die bevolking te maak. Die voedingstatusopname het bestaan uit 'n kliniese beoordeling van die voedingstoestand van die kind, bepaling van die graad van verkalking van die handwortelbeentjies deur X-straalondersoek, 'n hematologiese en biochemiese ontleding van die bloed, 'n somatometriese ondersoek, ondersoek van 'n urienmonster en ook 'n parasitologiese ondersoek van die stoelgang. In die kliniese ondersoek is ook gelet op die moontlike teenwoordigheid van aansteeklike siektes. Die Departement van Gesondheid het X-straalopnames gemaak ten einde die voorkomssyfer van tuberkulose te bepaal. Intelligensietoetse is ook op die kinders deur die Nasionale Buro vir Opvoedkundige en Maatskaplike Navorsing van die Departement van Onderwys, Kuns en Wetenskap uitgevoer.

Gegewens verkry tydens die opname het, by vergelyking met standarde vir Blanke kinders, afwykings in die bloedsamestelling en verkalking van die handwortelbeentjies getoon, waarvoor daar nie 'n voor die hand liggende verklaring is nie, en daar is besluit om 'n soortgelyke ondersoek op 'n groep verstedelike Bantoe-kinders uit te voer in 'n poging om standarde vir vergelykingsdoeleindes op te stel. 'n Groot groep kinders van dieselfde ouderdom van Atteridgeville, naby Pretoria, is hiervoor gekies.

Na voltooiing van die voedingstatusondersoek is 'n voedselaanvullingsstudie met vrywillige kinders by Koffykraal en Grootfontein ingestel. Die kinders is statisties in vier groepe ingedeel en oor 'n tydperk van 'n jaar sal aan drie van die groepe daaglik 'n aanvullende voedsel gegee word. Die proef geskied onder toesig van die plaaslike Bantoe-onderwyspersoneel en verpleegters,

and it was found that the serum copper content of the adult Bantu is considerably higher than that of the adult European of the same age and sex. So far, an insufficient number of children of the two racial groups have been examined to enable any inferences to be drawn about the position in the lower age groups.

## FIELD NUTRITION STUDIES

### Supplement Studies

A start has been made with supplementary foodstuff studies in selected Native kraals in the Western Transvaal, viz. Koffykraal and Grootfontein. The Native tribes concerned were selected because they live in comparatively isolated areas and lead very simple and primitive lives; the European pattern of life is still fairly well in the background. The staple diet is mainly kaffir-corn, to a certain extent supplemented with foods derived from wild plants growing in the surrounding areas.

The study was preceded by a determination of the nutritional status of children within the age group 5-8 years, and an attempt was, as far as possible, made to conduct a diet survey of the population. The nutritional status survey consisted of a clinical evaluation of the nutritional status of the child, determination of the degree of calcification of the carpal bones by means of X-ray examination, a haematological and biochemical blood analysis, a somatometric examination, examination of a sample of urine and also a parasitological examination of the faeces. In the clinical investigation attention was also paid to the possible presence of contagious diseases. The Department of Health carried out X-ray surveys to determine the incidence of tuberculosis. Intelligence tests on the children were done by the National Bureau of Education and Social Research of the Department of Education, Arts and Science.

When compared with the standards of European children, data collected during this survey, showed differences in the composition of the blood and calcification of the carpal bones, for which there is no obvious explanation, and it was decided to carry out a similar investigation on a group of urbanized native children in an attempt to establish standards for purposes of comparison. A large group of children of the same age were selected for this purpose at Atteridgeville, near Pretoria.

After completion of the nutritional status investigation a nutritional supplementary study was conducted on children who volunteered at Koffykraal and Grootfontein. The children were divided statistically into four groups and to three of these groups supplementary food will be given every day for a period of one year. The test was carried out under the supervision of local Native teachers and nurses, the District Surgeon and the medical staff of the Field Studies Division of the Institute.

die Distriksgeneesheer en die geneeskundige personeel van die Afdeling Veldstudies van die Instituut.

Die Departemente Naturellesake, Voeding, Gesondheid en Onderwys, Kuns en Wetenskap en die Gesondheidsafdeling van die Stadsraad van Pretoria het met groot welwillendheid meegewerk.

## WANVOEDING EN GEESTESSTEURNIS

'n Ondersoek word uitgevoer in die Weskoppiesinrigting (Pretoria) op pasiënte by wie daar 'n aanduiding is dat onder- of wanvoeding moontlik 'n rol mag speel in die ontstaan van die geestelike steurnis. Pasiënte wat ly aan organiese psigose of klassieke skisofrenie word sover moontlik nie in die ondersoek ingesluit nie.

Tot dusver is 18 pasiënte ondersoek. Volledige kliniese, somatometriese, hematologiese, biochemiese en parasitologiese ondersoeke word uitgevoer by toelating tot die inrigting. 'n Ondersoek van die inrigtingsdiët van die pasiënte, 'n kliniese ondersoek van die pasiënte en 'n baie volledige biochemiese ondersoek van die bloed- en urienmonsters word na periodes van 1, 2 en 6 weke herhaal. Hierdie ondersoek sal moontlik lig werp op die vraag of voedingsgebreke verband hou met sekere tipes geestessteurnis.

## METODIEK

Gegewens aangaande die metaboliese faecesstikstof- en endogene urienstikstofverliese van 262 albinorotte is aan statistiese toetsing onderwerp, met die doel om 'n verkorte rotmetode vir die bepaling van proteïenwaarde te ontwikkel. Volgens die bevindings kan betreklik akkurate skattings van die metaboliese faecesstikstof van beide mannetjie- en wyfierotte gemaak word deur die aanwending van formules deur die Instituut afgelei.

Deur van die formules gebruik te maak, kan die biologiese waardes en verteerbaarheid van proteïene binne 17 tot 20 dae bepaal word met dieselfde graad van akkuraatheid as wat met langtermynmetodes (wat tot 42 dae vereis), gedoen kan word.

Beskikbare inligting het ook aangedui dat heersende seisoensinvloede die respons van rotte ten opsigte van die proteïen in die diët kan affekteer. Derhalwe is dit noodsaaklik gevind om 'n standaardproteïen in elke toetsreeks aan 'n identiese diergroep te voer en die invloed van seisoensveranderinge deur die aanwending van 'n geskikte omrekeningsfaktor te elimineer. Op hierdie wyse kan resultate, wat in verskillende seisoene van die jaar verkry is, vergelykbaar gemaak word.

## SITOLOGIE

'n Senior lid van die Instituut het besoek afgelê by verskeie sitologiese laboratoria in die buiteland ten einde

The Departments of Native Affairs, Nutrition, Health, and Education, Arts and Science and the Health Department of the Pretoria Municipality gave their assistance in this matter.

## MALNUTRITION AND MENTAL DISTURBANCES

An investigation is in progress at the Weskoppies Mental Hospital (Pretoria) on patients showing signs of underfeeding or malnutrition which may have played a role in causing mental disturbance. Patients suffering from organic psychosis or classical schizophrenia are as far as possible not included in the investigation.

So far 18 patients have been examined. Full clinical, somatometric, haematological, biochemical and parasitological examinations were carried out on admission to the hospital. An investigation of the patients' hospital diet, a clinical examination of the patients and a very full biochemical examination of samples of blood and urine are repeated after periods of 1, 2 and 6 weeks. This investigation will probably throw some light on whether nutritional deficiencies are in any way connected with certain types of mental disturbance.

## METHODOLOGY

Data in connection with metabolic faecal nitrogen and endogenous urine nitrogen losses of 262 albino rats were subjected to statistical tests, with the object of developing an accelerated rat method for the determination of protein values. Experience has shown that fairly accurate estimations can be made of the metabolic faecal nitrogen in both male and female rats by the application of formulae deduced by the Institute.

By applying these formulae the biological values and digestibility of proteins can be determined within 17 to 20 days, with the same degree of accuracy as in the case of long-term methods (requiring up to 42 days).

Available information also showed that prevalent seasonal influences may affect the response of rats to protein in the diet. It was therefore found necessary to feed a standard protein in every test series to an identical group of animals and to eliminate the effect of seasonal changes by applying a suitable conversion factor. Results obtained in the various seasons of the year can thus be made comparable.

## CYTOLOGY

A senior official of the Institute visited several cytological laboratories overseas with the object of studying



'n studie te maak van metodes vir die elektronmikroskopiese ondersoek van die bloed asook van die jongste metodes vir die voorbereiding van weefsels vir elektronmikroskopiese ondersoek. Die voorbereidingsstegniek soos toegepas in die Rockefeller-Instituut vir Mediese Navorsing in New York is veral in fyn besonderhede bestudeer, en hierdie tegniek sal toegepas word in alle toekomstige sitologiese studies. Deur gebruik te maak van die groter oplosvermoë van die elektronmikroskoop sal die eerste intrasellulêre veranderinge wat in organe en weefsels by verskillende voedingsgebreke optree, bestudeer kan word. Die elektronmikroskoop in die Nasionale Fisiese Laboratorium sal vir hierdie studies gebruik word.

## GRANE EN GRAANPRODUKTE

### Verhoging van Voedingswaarde van Mieliemeel

Daar is nagegaan of dit moontlik sou wees om die voedingswaarde van meliemeel te verbeter deur hittebehandeling (outoklaving) van die rou meliemeel met of sonder byvoeging van chemikalieë soos kalsiumkarbonaat, kalsiumhidroksied en ammoniumkarbonaat. 'n Reeks van tien biologiese waardebepalings is met rotte uitgevoer om vas te stel of enige verbetering van die proteïenkwaliteit deur die behandelingsprosesse verkry kan word. Volgens die verkreeë resultate kon slegs 'n geringe verbetering aangebring word, en wel deur middel van die gewone huishoudelike metode om pap te kook. Ander metodes het of geen uitwerking op die proteïenkwaliteit nie, of dit lei tot 'n daadwerklike afname van of die verteerbaarheid of die biologiese waarde van die proteïen in die produk.

Die B-vitamiënpatroon van die meliemeel word egter baie verander. By behandeling met ammoniumkarbonaat word byvoorbeeld 40 persent van die vitamien B<sub>1</sub> vernietig, terwyl die vitamien B<sub>2</sub>-gehalte onveranderd bly. Die beskikbare niasien (nikotiënsuur) word egter deur die proses verhoog met van 100 tot 200 persent. Hierdie verskynsel is moontlik te wyte aan die feit dat 'n groot gedeelte van die niasien in gebonde vorm in die melië aanwesig is en deur hierdie behandeling beskikbaar gestel word.

### Broodverryking

Van die mees gevestigde projekte waaraan die Instituut reeds sedert sy totstandkoming aandag skenk, is die verbetering van die proteïenkwaliteit van brood. Hierdie werk word gedoen ten behoeve van die Departement van Voeding.

In hierdie verband is veral ondersoek gedoen op die proteïenaanvullingswaarde van vismeelblom, soos tans in Suid-Afrika onder toesig van die Visnywerheidsnavorsingsinstituut vervaardig word. Uit die bevindinge verkry met proefdiere, het geblyk dat wanneer daar terselfdertyd ruim voorsien word in die minerale-, vitamien- en kalorie- en ander behoeftes van die proefdiere, vismeelblom die proteïenkwaliteit van die brood aan-

the methods for the electron-microscopic examination of blood, as well as the latest methods for the preparation of tissues for electron-microscopic examination. In particular, a detailed study was made of the method of preparation used at the Rockefeller Institute for Medical Research in New York and this technique will be applied in all future cytological studies. By making use of the greater dissolving power of the electron microscope it will be possible to study the first intracellular changes occurring in organs and tissues with various nutritional deficiencies. The electron microscope in the National Physical Laboratory will be used for these studies.

## CEREALS AND CEREAL PRODUCTS

### Improvement of the Nutritive Value of Maize Meal

The possibility of improving the nutritive value of maize meal by heat treatment (in an autoclave) of the raw maize meal either with or without the addition of chemicals such as calcium carbonate, calcium hydroxide and ammonium carbonate, was investigated. A series of ten biological assessments was carried out with rats to establish whether any improvement of the protein quality could be obtained, by such treatment. The results obtained revealed that only a slight improvement could be obtained, namely, by means of the ordinary domestic method of cooking porridge. Other methods either had no effect on the quality of the protein, or they led to a definite reduction of the digestibility or of the biological value of the protein in the product.

The B-vitamin pattern of maize meal, however, shows a considerable change. On treatment with ammonium carbonate, for instance, 40 per cent of the Vitamin B<sub>1</sub> is destroyed, while the vitamin B<sub>2</sub> content remains unaltered. The available niacin (nicotinic acid) on the other hand is increased by 100 to 200 per cent during the process. This phenomenon may be due to the fact that a large proportion of the niacin is present in the meal in the fixed form and is made available by this treatment.

### Bread Enrichment

Among the oldest projects to which the Institute has given attention ever since its establishment, is the improvement of the protein quality of bread. This work is being done on behalf of the Department of Nutrition.

The investigations in particular cover the protein supplementary value of fish flour, as at present produced in South Africa under the supervision of the Fishing Industry Research Institute. The results obtained with test animals reveal that if ample provision is made simultaneously for the minerals, vitamins, and calories and other requirements of the test animals, fish flour can improve the protein quality of the bread considerably.

sienlik kan verbeter. Voedingsprobleme is egter baie gekompliseerd van aard en sluit ten nouste aan by ander probleme soos die totale dieetpatroon en behoeftes van daardie deel van die bevolking wat uiteindelik die voedsel sal moet eet. Ook moet daar aan toksikologiese en ekonomiese aspekte oorweging geskenk word. Derhalwe beskik die Instituut in hierdie stadium nog nie oor voldoende gegewens om finale gevolgtrekkings te kan maak ten opsigte van vismeelblom as broodverrykingsmiddel nie. Verdere werk oor hierdie probleme duur egter voort.

Benewens bostaande werk is ook vir die eerste maal sedert die stigting van die Instituut 'n eksperiment uitgevoer om die invloed van gewone brood en brood verryk met 4 persent vismeelblom op die stikstofbalans van 25 proefpersone uit te toets. Hoofsaaklik vanweë die uiteenlopende resultate wat in hierdie eksperiment van proefpersoon tot proefpersoon verkry is, het die waarde van die vismeelblom egter in hierdie proef nie so duidelik op die voorgrond getree soos gewoonlik in rotproewe die geval is nie.

Proewe is tans nog aan die gang om die waarde van ontvette grondbonemeel en melkpoeier (in byvoegings van tot 12 persent) in brood te ondersoek.

Ten behoeve van die Departement van Voeding oefen die Instituut ook kwaliteitskontrole oor die broodverrykingsmateriale uit. Nuwe gewysigde voorskrifte wat beide die chemiese en mikrobiologiese vereistes vir die bakkersvet en verrykingsmengsels vaslê, is vir die Departement opgestel. Monsters van die verrykingsmengsel, die bestanddele daarvan, asook van bakkersvet wat deur die Departement ingestuur word, word gereeld chemies ontleed en mikrobiologies ondersoek.

Proewe is ook uitgevoer om die effek van verryking van brood met vismeelblom op die voorkoms van leng in die brood vas te stel. Die hoeveelheid lengbestrydingsmiddel wat benodig word vir verskillende samestellings van die verrykingsmengsel is ook bepaal.

Om 'n indruk te verkry van neigings in die verbruik van die verskillende tipes brood word 'n ondersoek oor broodverbruik in Pretoria en omgewing uitgevoer. Gegewens van die bakkerie oor broodverkope in die verskillende woongebiede in periodes ses maande uitmekaar, word statisties ontleed. Die ondersoek behoort lig te werp op neigings in die verbruik van die verskillende tipes brood en behoort ook 'n aanduiding te gee van die totale broodverbruik in verskeie van die stedelike Naturellegebiede.

### Magou

Navorsing oor die verryking van magou is voortgesit en proewe is gedoen met die oog op verryking ten opsigte van proteïene, vitamïene en minerale. Dit was moontlik om 'n smaaklike magou te berei wat 10 persent vismeelblom, 5 persent ontvette grondbonemeel en 2 persent voedselgis, bereken op die gewig meliëmeel in die magou,

Nutritional problems are very complicated, however, and are very closely related to other problems, such as the total diet pattern and the requirements of that section of the population which will eventually have to eat the food. Consideration should also be given to the toxicological and economic aspects. Consequently, the Institute has not at this stage sufficient data at its disposal to be able to draw final conclusions concerning fish flour as a means of enriching bread. Work on this subject is being continued.

In addition to the above activities, an experiment has been carried out for the first time since the Institute was founded, to determine the effect of ordinary bread and of bread enriched with 4 per cent fish flour on the nitrogen balance of 25 test persons. Mainly owing to the widely divergent results obtained in this experiment from the one test person to the other, the value of the fish flour was not as apparent during this test as it usually is in the case of rat experiments.

Tests are at present still being carried out to investigate the value of adding defatted peanut flour and milk powder (in quantities of up to 12 per cent) in bread.

On behalf of the Department of Nutrition, the Institute carries out quality control on the materials used for enriching bread. New amended rules laying down both chemical and microbiological requirements for bakers' fat and enrichment mixtures, were drawn up for the Department. Samples of the enrichment mixture and its components, as well as of bakers' fat submitted by the Department are regularly subject to chemical analysis and microbiological tests.

Experiments have also been carried out to determine the effect of enriching bread with fish flour on the occurrence of rope in bread. The amount of anti-rope agent required for various compositions of the enrichment mixture has also been determined.

To get an idea of tendencies in the consumption of the various types of bread, a survey is being made of bread consumption in Pretoria and its environs. Data obtained from the bakeries in regard to bread sales in the various residential areas over periods six months apart are being statistically analysed. This investigation should throw light on tendencies in the consumption of various types of bread and should also give an indication of the total bread consumption in several of the Native urban areas.

### Magou

Research into the enrichment of magou was continued and experiments were carried out covering enrichment as regards proteins, vitamins and minerals. It was found possible to prepare a palatable magou containing 10 per cent fish flour, 5 per cent defatted peanut meal and 2 per cent food yeast, calculated on the weight of maize



bevat. Die smaak van so 'n verrykte magou verskil weinig van die smaak van normale magou.

Om vas te stel of die vry melksuur, wat in gedroogde magou in hoeveelhede van 5-6 persent voorkom, die proteïenkwaliteit van 'n proteïenverrykte magoumonster enigszins benadeel en of die melksuur enige nadelige invloed op die proteïenassimilasievermoë van rotte het, is ondersoek gedoen op die proteïenmetabolisme van rotte wat die produk in 'n gebalanseerde rantsoen (bevattende tot 67 persent droë magoupoeier) ontvang het. Geen noemenswaardige effekte—hetsy ten voordele of ten nadele van die magou—kon waargeneem word oor 'n toetsperiode van 17 dae nie. Daarbenewens was die proteïenkwaliteit van die produk besonder goed. Dit blyk verder dat magou sal kan dien as 'n goeie en veilige draer van voedingstowwe wat die verbruikers daarvan nie deur ander kanale bereik nie. Beide vitamien C en sintetiese vitamien A kan by droë magoupoeier ingemeng word. Dit is selfs gevind dat 20 persent fyngemaakte wortels in magou ingemeng kan word as bron van vitamien A (karoteen), sonder om die smaak te benadeel.

## MELKPRODUKTE

### Melkpoeier

Studies oor die kwaliteit van melkpoeiers wat deur die Instituut gedoen is, het aan die lig gebring dat nie alle melkpoeiers wat op die Suid-Afrikaanse mark kom, van 'n hoë kwaliteit is nie. Vanuit 'n voedingsoogpunt gesien, is die Departement van Voeding gretig om die verbruik van afgeroomde melkpoeier te bevorder, maar dit kan slegs gedoen word as 'n goeie standaardkwaliteit bemark word. Ondersoek het egter getoon dat rollergedroogde afgeroomde melkpoeier, wat voedingswaarde betref, goed vergelyk met sproeigedroogde melkpoeier indien die rollerdrogingsproses goed uitgevoer word.

Dit was noodsaaklik om bruikbare toetsmetodes vir die studie van die kwaliteit van melkpoeier te ontwikkel, en oorsese voorskrifte en metodes wat betrekking daarop het, is krities bestudeer. Metodes is uitgewerk en aan die Suid-Afrikaanse vervaardigers beskikbaar gestel. Die samewerking van vervaardigers is verkry, en 'n reeks monsters ondersoek. Die resultate is aan die fabrikante meegeedeel.

### Kaseïen-weipoeiermengsel

Die regulasies van die Departement van Voeding laat toe dat 'n mengsel van kaseïen en weipoeier in plaas van melkpoeier in verrykte brood gebruik mag word.

'n Ondersoek is onderneem om vas te stel in hoeverre hierdie mengsel verskil van melkpoeier en om 'n metode te vind vir die kwaliteitsbepaling van die kaseïen wat vir die mengsel gebruik word. Die toepassing van so 'n metode is van die uiterste belang om te verseker dat kaseïen van hoë kwaliteit gebruik word.

meal in the magou. The flavour of this enriched magou differs little from that of ordinary magou.

To ascertain whether the free lactic acid occurring in magou powder in quantities of 5-6 per cent, in any way harms the protein quality of a protein-enriched sample<sup>1</sup> of magou and whether the lactic acid has any detrimental effect on the ability of rats to assimilate proteins, experiments were carried out on the protein metabolism of rats that had been fed the product in a balanced ration containing up to 67 per cent of dry magou powder. No effects worth mentioning—either for or against the magou—could be observed over a test period of 17 days. Furthermore the protein quality of the product was particularly good. It would appear that magou can serve as a good, safe carrier of nutritive substances which cannot reach consumers through any other channel. Both vitamin C and synthetic vitamin A can be used as an admixture to magou powder. It has even been found that 20 per cent grated carrots may be added to magou as a source of vitamin A (caroteen) without spoiling the taste.

## MILK PRODUCTS

### Milk Powder

A study of the quality of milk powders carried out by the Institute, revealed that not all milk powders marketed in South Africa are of high quality. From a nutritional point of view the Department of Nutrition is anxious to promote the consumption of skim milk powder, but this can only be done if a good standard quality is made available. Investigations have shown, however, that roller-dried skim milk powder, as far as nutritive value is concerned, compares well with spray-dried milk powder, provided that the roller drying process is properly carried out.

It became necessary to develop suitable test methods for the study of the quality of milk powders, and overseas regulations and methods in this connection were critically studied. Methods were evolved and made available to South African manufacturers. The collaboration of manufacturers was obtained. Numbers of samples were tested, and manufacturers informed of the results.

### Casein and Whey Powder Mixture

The regulations of the Department of Nutrition permit the use of a mixture of casein and powdered whey in place of milk powder in enriched bread.

An investigation was undertaken to determine to what extent this mixture differs from milk powder, and to find a method for the quality determination of the casein used in the mixture. The application of this method is of the utmost importance to ensure that casein of a high quality is used. The investigation revealed the possibility of

Die ondersoek het aan die lig gebring dat dit wel moontlik is om die kwaliteit van die kaseïen wat in die mengsel gebruik word, vas te stel, deur die bepaling van die hoeveelheid rein kaseïen. 'n Kaseïen-weipoeiernmengsel wat in die regte verhouding gemeng is en 'n goeie kaseïen bevat, kan egter nie deur hierdie metode van afgeroomde melkpoeier onderskei word nie. Dit is alleenlik met behulp van oplosbaarheidsbepalings wat daar vasgestel kan word of 'n kaseïenweipoeiernmengsel, of afgeroomde melkpoeier in die verrykingsmengsel gebruik is, aangesien laasgenoemde poeier meer oplosbaar is. Selfs al word 'n goeie sproeigedroogde weipoeier in die mengsel gebruik, kan op dié wyse tussen die twee onderskei word.

## BONE EN OLIESADE

### Grondbonemeel

Grondbonemeel kan nie vir die verryking van mielie-meel gebruik word nie deurdat so 'n verrykte mielie-meel 'n onaantreklike blou kleur kry wanneer dit in ysterpotte gekook word. Die meganiese en moontlike voorkoming van die verkleuring is bestudeer.

Dit is bekend dat die kleur van die nerf van die boontjie toegeskryf kan word aan die vier pigmente, leukoantosianiene, flavanone, tannoëde en flobafeen en ook dat 'n alkoholiese oplossing van flobafeen en tannien met ferrichloried 'n grys tot swart kleur gee. Dit dui daarop dat die blou verkleuring 'n reaksie is tussen yster (van die pot) en die tannien en flobafeen wat van die grondbonemeel afkomstig is.

Ondersoek het getoon dat hierdie reaksie net onder sekere toestande plaasvind, veral by pH-waardes bokant 5.4. Proewe is gedoen om die pH-waarde laer as 5.4 te hou deur toevoeging van suur wei, melksuur, sitroensuur, wynsteensuur en ook soutsuur en dit is gevind dat die blou kleurontwikkeling op hierdie manier voorkom kan word.

Vyf monsters grondbone met 'n natuurlike wit nerf, verkry van die Landboukollege, Potchefstroom, is ondersoek en daar is gevind dat geen verkleuring intree wanneer die ontvette meel, berei van hierdie grondbone, saam met mielie-meel in 'n ysterpot gekook word nie. Die gebruik van hierdie variëteite mag dus die oplossing bied vir die probleem van verkleuring.

## VISMEEL EN VISMEELBLOM

Tot die vismeelblomvervaardigingsprogramme wat in Suid-Afrika en elders in die wêreld aan die gang is, het die Instituut grootliks bygedra, hoofsaaklik deur die biologiese toetsing van die proteïenkwaliteit van 31 monsters vismeel en vismeelblom, insluitende enkele monsters walvismeel en kreefmeel. Hierdie monsters is ingestuur deur organisasies soos die Visnywerheid-

determining the quality of the casein used in the mixture by finding the amount of pure casein. A mixture of casein and whey powder mixed in the right proportions and containing good casein can, however, not be distinguished by this method from skim milk powder. Only by means of solubility determinations can it be established whether a mixture of casein and whey powder or skim milk powder has been used in the enrichment mixture, since the latter powder is more soluble. Even if good, spray-dried whey powder has been used in the mixture, it can still be distinguished in this manner.

## BEANS AND OIL SEEDS

### Peanut Meal

Peanut meal cannot be used for enriching maize meal, since the meal thus enriched turns an unattractive colour when cooked in iron pots. The mechanism and possible prevention of the discoloration has been studied.

It is known that the colour of the testa of the peanut is ascribable to four pigments luco-antocyanin, flavanone, tannoïde and phlobaphene, and also that an alcoholic solution of phlobaphene and tannin give a grey to black colour with ferric chloride. This seems to indicate that the blue discoloration is a reaction between the iron (of the pot) and the tannin and phlobaphene from the peanut meal.

Investigations have shown that this reaction takes place under certain circumstances only, especially at pH values exceeding 5.4. Tests were carried out to keep the pH below 5.4 by adding sour whey, lactic acid, citric acid, tartaric acid and also hydrochloric acid, and it was found that the blue discoloration could be prevented in this way.

Five samples of peanuts with a natural white skin, obtained from the Potchefstroom Agricultural College, were tested and it was found that no discoloration takes place when the defatted meal prepared from these peanuts, is cooked together with maize meal in an iron pot. Use of these varieties may therefore be the solution to the discoloration problem.

## FISH MEAL AND FISH FLOUR

The Institute has played an important part in the fish flour production programmes that are in progress in South Africa and elsewhere, mainly by the biological testing of the protein quality of 31 samples of fish meal and fish flour, including a few samples of whale meal, and crayfish meal. These samples were submitted by organizations like the Fishing Industry Research Institute,



navorsingsinstituut, S.A.B.S., I.R.S.A.C. (Belgiese Kongo) en VioBin Corporation (U.S.A.). In verband met hierdie werk kan gemeld word dat daar reeds in Suid-Afrika vismeelblom vervaardig kan word wat ten opsigte van proteïeninhoud en -kwaliteit goed vergelyk met die beste. Een buitelandse produk het egter nog 'n voor-sprong bo die Suid-Afrikaanse in soverre dat die verteerbaarheid daarvan—soos in rotproewe bepaal—noemenswaardig hoër is. Die volledige aminosuursamestelling van 'n Belgiese en van die Suid-Afrikaanse vismeelblom is ook bepaal deur die kolomchromatografiese skeidingsmetode. Laasgenoemde analise het ook getoon dat die Suid-Afrikaanse vismeelblom van goeie gehalte is.

In die vervaardiging van vismeelblom gaan daar egter baie van die voedingstowwe wat in vars vis teenwoordig is, verlore. Die vet, en daarmee die onversadigde en essensiële vetsure, lesitien en fostolipiede word verwyder. Met alkoholekstraksie kan ook belangrike hoeveelhede van die vitamïene verwyder word.

Navorsing word ook deur die Instituut gedoen om metodes te vind vir die behoud van al hierdie voedingstowwe, of, as alternatief, om verrykingsmengsels saam te stel waarin daar, met uitsondering van die lipiede, vergoed kan word vir die voedingstowwe wat verlore gaan in die vervaardiging van vismeelblom.

## SUID-AFRIKAANSE VOEDSEL-TABELLE

Die ontleding van saamgestelde monsters van mielies en mielieprodukte met die oog op die opstel van Suid-Afrikaanse voedseltabelle is gedurende die jaar afgehandel.

Die gemiddelde waardes wat verkry is, vergelyk oor die algemeen goed met dié wat in die Amerikaanse voedseltabelle aangegee word vir heelmielies en sommige mielieprodukte. Dit is egter opvallend dat die kalsium- en niasienwaardes van die Suid-Afrikaanse mielies laer is—in sommige gevalle selfs die helfte laer—as die Amerikaanse waardes.

Die monsters wat deur inspekteurs van die Raad van Beheer oor die Mielienywerheid getrek en aan die Instituut gestuur is, is so gekies dat dit mielies van al die belangrikste mielieproduserende gebiede ingesluit het. Die mielieprodukte-monsters is saamgestel uit monsters wat deur die groter meules vervaardig is. Aangesien nog net een monster geel rondpitmielies ontleed is, sal daar in die komende jaar nog verdere monsters van hierdie variëteit ontleed moet word om meer verteenwoordigende waardes te kry.

Met die oog op die opstel van tabelle vir melk en melkprodukte, aartappels, eiers, vleis en vleisprodukte, groentes, droëbone en oliesade en sagte en sitrusvrugte, is die samewerking van die Departement van Landbou en ander instansies verkry en komitees saamgestel om die Instituut behulpsaam te wees met die verkryging van analitiese gegewens oor hierdie produkte.

the S.A.B.S., the I.R.S.A.C. (Belgian Congo) and the VioBin Corporation (U.S.A.). In connection with this work it can be reported that fish flour in which protein content and protein quality compares favourably with the best, is already being produced in South Africa. One foreign product, however, is still ahead of the South African products, in that its digestibility—as determined by tests on rats—is appreciably higher. The complete amino acid composition of a Belgian and a South African fish flour has been determined by the column-chromatographic separation method. The latter analysis also revealed that South African fish flour is of good quality.

During the production of fish flour a great deal of the nutritive substances present in fresh fish is lost. The fat, together with the unsaturated and essential fatty acids, lecithin and phospholipides, is removed. By alcoholic extraction important amounts of vitamins can also be removed.

The Institute is engaged on research into methods for the retention of all the nutritive substances or alternately, of preparing enrichment mixtures in which, with the exception of the lipides, the nutritive substances that are lost during production of the fish flour, can be compensated.

## TABLES OF SOUTH AFRICAN FOODS

The analysis of compound samples of maize and maize products with a view to the establishment of tables of South African foods was completed during the year.

On an average the values obtained compare well with those given in the American foodstuff tables for whole grain "corn" and some maize products. It is remarkable, however, that the calcium and niacin values of South African maize are lower—in cases as much as 50 per cent—than the American values.

The samples drawn by Inspectors of the Mealie Control Board and submitted to the Institute, were selected in such a manner that maize from all the important maize-growing areas was included. The maize product samples consisted of those drawn from the larger mills. Since only one sample of yellow round-kernel maize has so far been analysed, further samples of this variety will be analysed next year in order to obtain more representative values.

For the purpose of preparing tables of milk and milk products, potatoes, eggs, meat and meat products, vegetables, dried beans and oil seeds and deciduous and citrus fruit, the collaboration of the Department of Agriculture has been obtained and committees have been formed to assist the Institute in obtaining analytical data in connection with these products.

# Nasionale Padnavorsingsinstituut

*Direkteur:* DR. P. J. RIGDEN

Gedurende die afgelope jaar het daar 'n geringe toename in personeel (meestal nie-gegradueerdes) plaasgevind maar die omvang van die Instituut se werksaamhede is nog uiters beperk weens gebrek aan navorsingsingenieurs. Die Spesiale Problemeseksie, waarna in die vorige verslag verwys is, is nou goed gevestig en 'n voldoende personeel is opgebou om die huidige navorsingsprogram aan te pak. Belowende uitslae word reeds verkry van die vibrasie- en golfvoortplantingstudies.

Op die gebied van padveiligheid is etlike nuttige voorlopige studies gemaak maar die beskikbare personeel is tot dusver beperk tot een ingenieur bygestaan deur statistikusse. Aansienlike hulp met hierdie werk is verleen deur die Departement van Sensus en Statistiek.

## **BITUMINEUSE MATERIALE EN OPPERVLAKE (NAVORSINGSEENHEID VIR BITUMINEUSE BINDSTOF)**

### **Bitumens van Olies uit die Midde-Ooste**

Padingenieurs het opgemerk dat bitumens wat geproduseer is by die raffinerie van rupetroleum wat nou uit die Midde-Ooste in die Unie ingevoer word, in gebruik anders reageer as dié wat voorheen regstreeks in die land ingevoer is. Laasgenoemde bitumens is verkry uit verskillende bronne, onder andere Venezolaanse, Trinidadse en Teksaanse rupetroleums. In 'n onlangse padeksperiment wat deur die Instituut uitgevoer is, is ook opgemerk dat onder koue weersomstandighede 'n ingevoerde bitumen en een wat verkry is uit 'n Saudi-Arabiese ru-olie verskillende adhesie-eienskappe getoon het. Daaropvolgende laboratoriumondersoeke het getoon dat die Venezolaanse bitumen baie beter adhesie met die klep het by lae temperature as die Saudi-Arabiese bitumen.

'n Oorsig van die fisiese en chemiese eienskappe van bitumens wat verkry is van hierdie verskillende rupetroleums het beduidende verskille in samestelling aan die lig gebring. Die bitumens wat tans in die Unie vervaardig word van die Saudi-Arabiese (Midde-Ooste) ru-olie het 'n ietwat hoër wasinhoud as bitumens wat van Venezolaanse en Trinidadse ru-olie vervaardig is en het 'n onbeduidende hoeveelheid suurbestanddele in vergelyking met die beduidende hoeveelheid wat in die Venezolaanse en Trinidadse bitumens aanwesig is. Die verskil in adhesiegedrag van die bitumens kan gedeeltelik aan hierdie verskille in die samestelling toegeskryf word.

Proefoppervlaklae is op die Pretoria-Warmbadpad naby Pienaarsrivier gelê om die werkverrigting van die

# National Institute for Road Research

*Director:* DR. P. J. RIGDEN

The past year has seen some increases in staff (mostly non-graduates), but the scope of much of the Institute's work is still severely limited by the lack of research engineers. The Special Problems Section referred to in the last report has now firmly established itself and built up an adequate staff for its present research programme. Promising results are already coming forward from the vibration and wave propagation studies.

In the road safety field some useful preliminary studies have been made, but the staff available has so far been limited to one engineer with assistance from statisticians. Considerable assistance in this work has been given by the Department of Census and Statistics.

## **BITUMINOUS MATERIALS AND SURFACING (BITUMINOUS BINDER RESEARCH UNIT)**

### **Bitumens from Middle East Oils**

Road engineers have observed that bitumens produced in the refining of the Middle East crude petroleum, now imported into the Union, behave differently in use from those previously imported directly into the country. The latter bitumens were derived from several different sources which included Venezuelan, Trinidad and Texan crude petroleums. In a recent road experiment carried out by the Institute, it was also observed that, under cold weather conditions, an imported bitumen and one derived from the Saudi-Arabian crude showed different adhesion properties. Subsequent laboratory investigation indicated that Venezuelan bitumen has much better adhesion to stone at low temperatures than the Saudi-Arabian bitumen.

A survey of the physical and chemical properties of bitumen derived from these different crude petroleums has indicated significant differences in composition. The bitumens now produced in the Union from the Saudi-Arabian (Middle East) crude oil have a somewhat higher wax content than bitumens produced from Venezuelan and Trinidad crudes, and have a negligible amount of acidic constituents as compared with the significant amount present in the Venezuelan and Trinidad bitumens. The difference in the adhesion behaviour of the bitumens can, in part, be explained by these differences in composition.

Experimental surfacings were laid on the Pretoria-Warmbaths road near Pienaar's River to compare the



Saudi-Arabiëse en Venezolaanse bitumens te vergelyk wanneer hulle gebruik word vir die herverseëling van 'n bestaande bitumineuse oppervlaklaag.

#### Verbetering van Kooksoondtere

Werk in verband met die verbetering van die padprestasie van Suid-Afrikaanse kooksoondtere is voortgesit. Metodes om in beperkte mate die vlugtheid van die plastiserende olies te verminder, is ontwikkel en aandag word tans geskenk aan die verbetering van die brosheids- en vloei-eienskappe van die stof.

Dispersie van kunsubber of die opname van steenkool in teer by hoë temperature verleen 'n verbeterde vloeiweerstandvermoë by hoë padtemperature, en minder neiging tot brosheid by lae padtemperature. Indien beide toevoegings egter saam gebruik word, is die verbetering van die vloei-eienskappe van teer groter as verwag sou word wanneer die een of die ander apart gebruik word. Vir hierdie gesamentlike behandeling met beide kunsubber en steenkool is aansoek om patentering gedoen.

Die vloei-eienskappe van teer kan ook deur vermenging met petroleumbitumen verbeter word. Twee nuwe metodes is ontwikkel vir die vervaardiging van homogene en bestendige teer-bitumenmengsels in enige gewenste verhouding. Dit kan gedoen word of deur die twee bestanddele warm te vermeng en die neerslag uit die warm mengsel te verwyder of deur die toevoëing van natuurlike of kunsubber. Vir die tweede metode is ook aansoek om patentering gedoen.

Tere wat nie baie vlugtig is nie, en tere en teerbitumenmengsels wat gewysig is deur die toevoëing van steenkool of rubbersoorte is berei in hoeveelhede van 500 gelling en in 'n onlangse padeksperiment op die Pretoria-Warmbadpad naby Pienaarsrivier gebruik.

#### Instandhoudingsprobleme in koue Weer

Normaalweg word die instandhouding van bitumineuse oppervlakte deur herverseëling nie in die koue seisoen onderneem nie omdat gewoonlik moeilikheid ondervind word om by 'n lae padtemperatuur adhesie tussen die normale somergraad-bindstof en die klip te verkry. As werk met sukses in koue droë weer uitgevoer kon word, sou padowerhede beter in staat wees om hulle jaarlikse instandhoudingsprogram op te stel en die moontlikheid om dwarsdeur die jaar te werk sou dan ook lei tot 'n groot besparing in masjienhuurkoste en man-ure.

In die winter van 1957 is proefoppervlakke op die Pretoria-Kempton Parkpad naby Olifantsfontein gelê om verskeie metodes van herverseëling in koue, droë weer te ondersoek. Geslaagde herverseëling onder hierdie omstandighede is uitgevoer met behulp van vloei-bitumens of bitumenemulsies of van somergraadbitumen met of kreosootbedekte klip of deur verstuiwing van kreosoot op die laag opgespuitte bitumen voordat die klip versprei word. Die inligting wat tot dusver ingewin is, word

performance of the Saudi-Arabian and Venezuelan bitumens when used for resealing an existing bituminous surfacing.

#### Improving Coke-Oven Tars

Work on ways of improving the road performance of South African coke-oven tars continued. Methods for reducing, to a limited extent, the volatility of the plasticizing oils were developed and attention is now being directed to improving the brittleness characteristics and flow properties of the material.

Dispersion of synthetic rubber or digestion of coal in the tar at high temperature gives improved resistance to flow at high road temperatures and less tendency to brittleness at low road temperatures. When these additives are used together, however, the improvement in rheological properties is greater than would be expected from either separately. This combined treatment with both synthetic rubber and coal is the subject of a patent claim.

Another method of improving the rheological properties of tar is by admixture with petroleum bitumen, and two new methods of producing homogeneous and stable tar-bitumen blends in any desired proportions were developed. This can be done either by mixing the two components hot and removing precipitated material from the hot mixture, or by the addition of natural or synthetic rubber. The second method is also the subject of a patent claim.

Tars of low volatility and tars and tar-bitumen mixtures modified by the addition of coal and rubbers were prepared on a 500 gallon scale and used in a recent road experiment on the Pretoria-Warmbaths road near Pienaar's River.

#### Cold Weather Maintenance Problems

Normally, maintenance of bituminous surfacings by resealing is not carried out in the cold season because of the difficulty of obtaining adhesion between the normal summer grade binder and the stone when the road temperature is low. If work could be successfully done in cold dry weather, road authorities would be better able to plan their annual maintenance programmes, and 'round the year' work would lead to a large savings in plant hire costs and 'man-hours' working time.

Experimental surfacing was laid on the old Pretoria-Kempton Park road near Olifantsfontein in the winter of 1957 to investigate various methods for resealing in cold dry weather. Successful resealing under these conditions was achieved by using cut-back bitumens or bitumen emulsions, or by using summer-grade bitumen either with creosote-coated stone or by applying a fog spray of creosote on to the film of sprayed bitumen before spreading the stone. The information so far

tans aan padingenieurs in die Unie vrygestel sodat hulle self winterproewe kan doen met die mees belowende metodes.

## GRONDMEGANIKA EN PADFONDAMENTE

### Fondamentontwerp

Uitbreiding van die kennis in die jongste tyd oor die gedrag van padstrukture onder verkeer het getoon hoe belangrik dit is dat sowel die sterkte van die grondlae van 'n padfondament as die oorgangs-deformasie wat die struktuur ondergaan wanneer 'n swaar wielbelasting daaroor gaan, in aanmerking geneem behoort te word. Die werklike deformasies wat plaasvind onder die dubbele wiele van 'n swaar vragmotor is deur middel van die Benkelman-balkapparaat op verskeie paaie in verskillende dele van die land gemeet, en 'n verband is gevind tussen die toestand van die pad en die tipe en grootte van die deformatsie; swak padkondisies word vereenselwig met groot deformasies en omgekeerd.

Navorsing in verband met die skuifsterkte van onversadigde grondsoorte en ten opsigte van hulle gedrag onder verskillende vogtoestande is voortgesit. Studies van die spannings in die verskillende lae van 'n padfondament wat veroorsaak word deur verdigtings-wersaamhede of oppervlakbelastings het 'n aanvang geneem.

Die kombinasie van hierdie studies in die veld en dié in die laboratorium sal hopelik tot 'n verstandiger benadering van die ontwerp van padfondamente vir Suid-Afrikaanse toestande lei.

### Uitsittende Grondsoorte

Dit is bekend dat klein veranderings in die voggehalte van grondsoorte in sommige gevalle groot veranderings in sowel die sterkte as die bestendigheidseienskappe van padfondamente kan veroorsaak. As deel van die navorsingsprogram in verband met die beweging en verspreiding van vog in die grond, is veldstudies voortgesit en uitgebrei. Noukeurige waarnemings word nou van tyd tot tyd gedoen op ses padseksies in die Oranje-Vrystaat en Transvaal waar die uitsettings- of krimpings-bewegings wat in paaie oor klei-onderlae voorkom gemeet word. By die jongste proefperseel (naby Welkom) is oor 'n afstand van 150 vt. 300 penne in die padoppervlak geslaan om die horisontale (tot 0.0001 dm.) sowel as die vertikale bewegings te meet met betrekking tot 'n diep verwysingspunt. Hierdie studies het alreeds duidelik die belangrike uitwerking wat die soort klimaat op die gedrag van grondsoorte het, laat uitkom, en in 'n wyer sin het dit tot 'n beter begrip van die gedrag van dergelike grondsoorte in verskillende dele van die wêreld gelei.

### Verwering van Rotsmateriale

Studies in verband met verweerde rotse met die oog op hul gebruik as padmateriaal in verskillende dele van die

obtained is being circulated to road engineers in the Union to enable them to carry out their own winter trials of the most promising methods.

## SOIL MECHANICS AND ROAD FOUNDATIONS

### Foundation Design

Recent advances in knowledge on the behaviour of road structures under traffic have established the importance of considering not only the strength of soil layers in a road foundation, but also the transient deformation produced in the structure under the passage of a heavy wheel load. The deformations that actually occur under the dual wheels of a heavy truck have been measured by the Benkelman Beam apparatus on several roads in different parts of the country and some correlation has been found between the condition of the road and the type and magnitude of deformation, poor road conditions being associated with large deformations and vice versa.

Research on the shear strength of non-saturated soils and on their behaviour under different moisture conditions has been continued. Studies have been started on the stresses set up in the various layers of a road foundation by compaction operations or by surface loads.

The combination of these studies in the field and laboratory will, it is hoped, lead to a more rational approach to the design of road foundations for conditions in South Africa.

### Expansive Soils

It is known that small changes in the moisture content of soils can, in some cases, cause large changes in both strength and stability properties of road foundations. As part of the programme of research on the movement and distribution of moisture in soil, field studies have been continued and extended. Precise observations are now being made periodically on six road sites in the Orange Free State and the Transvaal for the measurement of swelling or shrinking movements occurring over clay sub-grades. In the most recent installation (near Welkom) 300 pegs have been fixed in the road surface over a 150 ft. section to measure lateral movements (to 0.0001 in.) as well as vertical movements referred to a deep bench mark. These studies have already emphasized the important effect of the type of climate on the behaviour of soils and, in a wider perspective, have allowed of a better understanding of the behaviour of similar soils in different parts of the world.

### Weathering of Rock Materials

Studies of weathered rocks for use as road materials in different parts of the country were continued and once



land is voortgesit en weereens het geblyk hoe belangrik die invloed van klimaatstoestande op beide die vorming van grond en sy toekomstige padbou-eienskappe is. Vordering is gemaak met werk in die laboratorium op die gebied van monstervoorbereiding en die uitkenning van kleiminerale.

#### **Grondkartografie**

Hulp is verleen by wyse van 'n toekenning aan 'n lid van die personeel van die Witwatersrandse Universiteit vir studie oorsee van die jongste tegnieke in lugfotografie en die interpretasie daarvan vir grondkartografie.

### **SPEZIALE PROBLEME EN TEGNIEKE**

#### **Die Meganisme van Oppervlakverbrokkeling**

As deel van 'n langtermynstudie van die meganisme van uitrafeling of geleidelike verbrokkeling van bituminiese oppervlakke is bepalings voortgesit van die visko-elastiese eienskappe van beide vars en verweerde padbindstowwe onder vibrerende belasting oor 'n reeks frekwensies en toetstemperature. Dit is gedoen om kondisies in die praktyk na te boots, waar die bindstoflaag wanneer dit as 'n bindmiddel in die slytlaag van 'n pad gebruik word voortdurend deur verkeer aan spannings van korte duur blootgestel word wat dikwels, veral onder koue weersomstandighede of as die bindstof verweer het, veroorsaak dat die breeksterkte van die laag oorskry word onder herhaalde belasting en dus tot verbrokkeling van die oppervlak lei. Bindstofeienskappe wat op hierdie manier bepaal word, is die elastisiteitsmodulus en die verwante dempingsfaktor, wat albei van frekwensie en temperatuur afhang. Pogings word aangewend om 'n korrelasie te vind tussen funksies wat bogenoemde parameters bevat en die werkverrigtings-eienskappe van die bindstowwe in die praktyk.

As deel van hierdie projek is die belastingstyd en die grootte van die oorgangskragte wat deur die wiele van bewegende voertuie op die padoppervlak uitgeoefen word, onder praktiese toestande op die pad gemeet. 'n Apparaat wat spesiaal vir hierdie doel ontwikkel en gebou is, is opgestel in 'n padoppervlak ongeveer 10 myl wes van Pretoria en is gebruik om die vertikale en horisontale komponente van hierdie kragte te meet met betrekking tot 'n reeks faktore soos byvoorbeeld tipe voertuig, voertuigsnelheid, lugdruk in bande, asbelasting, versnelling en remming.

#### **Defleksiekraking van Oppervlakke**

'n Soortgelyke probleem as bogenoemde vereis die studie van die meganisme wat krake in 'n padoppervlak veroorsaak deur herhaalde belasting deur die verkeer. 'n Elektro-magnetiese vibrator is gebou waarmee die padstruktuur aan aanhoudende belasting oor 'n frekwensie-gebied onderwerp kan word. Bepalings van die kragte wat uitgeoefen word op die padoppervlak, word

again the important effect of climate on both the formation of a soil and on its future engineering properties was observed. Developments in laboratory work took place in the field of sample preparation and identification of clay minerals.

#### **Soil Mapping**

Assistance was given in the form of a grant to a member of the staff of the University of the Witwatersrand for an overseas study of the latest techniques in aerial photography and in the interpretation of aerial photographs for soil mapping.

### **SPECIAL PROBLEMS AND TECHNIQUES**

#### **The Mechanism of Surface Wear**

As part of a long-term study of the mechanism of ravelling or progressive disintegration of bituminous surfacings, measurements were continued on the visco-elastic properties of both fresh and weathered road binders under vibrational loading, over a range of frequency and test temperature. This approach was made in order to simulate conditions in practice, where the binder film, used as a cementing material in the wearing surface of a road, is continually subjected by traffic to stresses of short duration which often, especially under cold conditions or where the binder has become weathered, result in the breaking strength of the binder film being exceeded under repetitional loading, thus leading to disintegration of the surface. Binding properties determined in this way are the modulus of elasticity and associated damping factor, both of which depend on frequency and temperature. Attempts are being made to find a correlation between functions involving the above parameters and the performance characteristics of the binders in practice.

As part of this project, measurements were made under practical conditions on the road of the loading time and magnitude of the transient forces exerted on the road surface by the wheels of moving traffic. An apparatus, specially developed and built for the purpose, was installed in a road surface about 10 miles west of Pretoria and was used to measure the vertical and horizontal components of these forces under a range of conditions, e.g. type of vehicle, vehicle speed, tyre inflation pressures, axle load, acceleration and braking.

#### **Deflection Cracking of Surfaces**

A somewhat similar problem involves a study of the mechanism of cracking of a road as a result of repetitional loading by traffic. An electro-magnetic vibrator has been built with which the road structure can be subjected to sustained vibrational loading over a range of frequency. Measurements of the forces exerted on the road surface are made by means of a piezo-electric pressure cell while

gemaak deur middel van 'n piëso-elektriese druk-sel terwyl die defleksie deur middel van 'n snelheidsopnemer gemeet word. Voorsorg is ook gemaak vir die verandering van die opgelegde massa om sodoende die verskynsel van grondresonansie oor 'n frekwensiereeks te ondersoek. Deur middel van hierdie proewe word die belasting/defleksie-eienskappe van 'n pad vasgestel en kan dit weer in verband gebring word met die vermoë van 'n pad om kraking onder herhaalde belasting te weerstaan.

#### **Golfvoortplantingstudies**

Twee aspekte van die probleem om golfvoortplantings-tegnieke te gebruik vir die toets van padmateriale en -strukture is ondersoek. Eerstens is bogenoemde apparaat gemodifiseer en gebruik om baie sterk seine in die padstruktuur op te wek vir studies in verband met die voortplanting van aanhoudende Rayleigh-golwe. Pogings word aangewend om die voortplantingsnelheid met die fisiese eienskappe van die lae wat ondersoek word, te korreleer. Wanneer hierdie metode volledig uitgewerk is, behoort dit vir kontroletoetsing van 'n pad tydens sy aanleg, gebruik te kan word.

Tweedens is die voortplanting van skokgolwe in grondlae ondersoek met besondere inagneming van die voortplantingsnelheid van drukgolwe. Die doel was om 'n eenvoudige toets te ontwerp waardeur die diepte van rotse onder die grondoppervlak voorspel kan word sowel as om 'n metode te vind waardeur die eienskappe en die diepte van verskillende grondlae wat die rots bedek, vasgestel kan word. 'n Apparaat word tans ontwikkel wat geskik is vir veldtoestande en waarmee golfsnelhede selfs vir kortgolfvoortplantingstye, deur middel van 'n neon-vergelyker en 'n elektriese seinvertragingmeganisme vasgestel kan word.

#### **KOSTE VAN PADKONSTRUKSIE EN -INSTANDHOUDING**

gedurende die verslagjaar het die Afdeling Ekonomie voortgegaan met werk in verband met die eerste gedeelte van die langtermynstudie van die koste van padkonstruksie en -instandhouding in die Unie. Gewoonlik vereis hierdie werk ondersoek van die dravermoë en koste van padbou- en instandhoudingstoerusting en 'n studie van die koste van padbou- en instandhoudingswerk. Die verlangde inligting is, en sal steeds ingesamel word in 'n bepaalde volgorde en mate van detail wat tot die onmiddellike voordeel van padowerhede en navorsingspersoneel van die instituut sal strek.

Gedurende die jaar is ook 'n ondersoek ingestel na die koste van verdigtings- en verwante werksaamhede, en 'n voorlopige verslag is oor hierdie onderwerp uitgebring. 'n Verdere verslag wat oor die organisasie en finansiering van padbou en instandhouding in die Unie handel, word tans opgestel terwyl terreinstudies in verband met die gebruik van sekere primêre padboustoerusting ook onlangs 'n aanvang geneem het.

the deflection is measured by means of a velocity pickup. Provision has also been made for varying the superimposed mass to investigate soil resonance phenomena over a range of frequency. From these tests the load/deflection characteristics of a road are determined and can be related to the ability of a road to withstand cracking under repetitive loading.

#### **Wave Propagation Studies**

Two aspects of the problem of using wave propagation techniques for the testing of road materials and structures were investigated. Firstly, the above apparatus was modified and used to generate very strong signals in the road structure for studies on the propagation of sustained Rayleigh waves. Attempts are being made to correlate the velocity of propagation with the physical properties of the layers being investigated. When fully developed this technique should provide a means for the non-destructive control testing of a road during construction.

Secondly, the propagation of shock waves in soil layers was investigated with special emphasis on the velocity of propagation of compressional waves, with the object of providing a simple test by which the depth of rock below the surface of the soil can be predicted, as well as providing a means of determining the properties and depths of various soil layers overlaying the rock. An apparatus suitable for field conditions is under development with which wave velocities can be determined, even for short wave-travel times, by means of a neon comparator and an electrical signal delaying mechanism.

#### **COSTS OF ROAD CONSTRUCTION AND MAINTENANCE**

During the period under review the Economics Section has continued its work on the first phase of the long-term study of the costs of road construction and maintenance in the Union. Generally, this work involves studies of the capacities and costs of construction and maintenance equipment, and studies of the costs of construction and maintenance operations. The required information has been, and will continue to be collected in a sequence and degree of detail which will be of most immediate benefit to the road authorities and the research staff of the Institute.

An investigation of the costs of compacting and related operations was also undertaken and a preliminary report issued. A further report, relating to the organization and financing of road construction and maintenance in the Union is in the course of preparation while site studies of the utilization of certain primary road construction equipment, have also recently been commenced.



## VERKEERS- EN PADVEILIGHEIDSTUDIES

Die eerste gedeelte van die verslagjaar is bestee aan die opstel van 'n omvattende oorsig van die huidige kennis van padongelukke en navorsing in die verband in die Unie en oorsee om die beplanning van navorsing te vergemaklik en om as voorligting vir komiteelede te dien.

Sedertdien is 'n ontleding gemaak van padongelukgewens in die Unie vir 'n tydperk van nege jaar (1947 tot 1955) met spesiale verwysing na dié tyd wanneer ongelukke plaasvind met betrekking tot die tyd van die dag en die dag van die week. 'n Merkwaardige bevinding by hierdie ontleding was dat daar in stadsgebiede tweemaal soveel ongelukke voorkom gedurende die drukste namiddagperiode as gedurende die drukste voormiddagperiode, hoewel die ooreenstemmende verkeersbelasting (volgens die beperkte verkeersgewens tot dusver beskikbaar) bra weinig groter in die namiddag as in die voormiddag blyk te wees. Dit dui daarop dat afgematheid by bestuurders in stede dalk 'n belangrike faktor is. Nietemin sal dit uitvoerige studies verg voordat vaste gevolgtrekkings gemaak kan word; daar sal veral nog meer gegewens in verband met die verkeerstrom verkry moet word. Planne is reeds beraam om gegewens te versamel in samewerking met die plaaslike owerhede.

## TRAFFIC AND ROAD SAFETY STUDIES

The first part of the year was occupied by the preparation of a comprehensive review of present knowledge about road accidents and research done in the Union and overseas, to help in planning further research and for the guidance of Committee members.

An analysis has since been made of road accident data for the Union for nine years (1947 to 1955) with special reference to the time of occurrence of accidents in relation to time of day and day of week. A significant finding in this analysis is that the afternoon accident peak in urban areas is more than twice the morning peak, although the corresponding traffic loads (from the limited traffic data so far available) appear to be only slightly greater in the afternoon than in the morning. This suggests the possible importance of the driver fatigue factor in the urban accident picture. More detailed studies are needed, however, before firm conclusions can be drawn and in particular more data on traffic flow is required. Plans have already been made to obtain this data in co-operation with local authorities.

# Mediese Navorsing

*Ere-adviseur:* PROF. S. F. OOSTHUIZEN

## Komitees

Die Raad het sy Mediese en Tandheelkundige Navorsingskomitee gedurende die jaar as die Navorsingskomitee vir Mediese Wetenskappe heringestel en wel met die byvoeging van die Direkteur van die Suid-Afrikaanse Mediese Navorsingsinstituut as permanente lid.

Die afsterwe van prof. M. van den Ende van die Universiteit van Kaapstad wat as permanente lid gedien het, was 'n groot verlies vir die Komitee.

Prof. H. W. Snyman het aan die einde van 1957 as lid van die Komitee bedank en was ooreenkomstig die Komitee se konstitusie vir een jaar nie herkiesbaar nie. Dr. R. A. Alexander, Direkteur van Veeartsenydienste en dr. W. H. Craib is in die plek van prof. Snyman en wyle prof. Van den Ende benoem, terwyl prof. J. N. Coetzee en dr. A. Kipps as plaasvervangers in die plek van dr. Alexander en dr. Craib benoem is.

Die Raad wil hierby graag sy waardering uitspreek teenoor die lede van die Navorsingskomitee vir Mediese Wetenskappe en die lede van die subkomitees vir mediese navorsing vir hulle volgehoue belangstelling en vir hulle leiding by die navorsingsprogramme van die mediese navorsingseenhede en -groepe.

## Fondse

'n Bedrag van ongeveer £126,450 is in Januarie 1958 toegewys vir mediese en tandheelkundige navorsing gedurende die boekjaar 1958/59 waarvan omtrent £18,150 vir mediese en tandheelkundige navorsing aan universiteite, £7,500 aan die Suid-Afrikaanse Instituut vir Mediese Navorsing en omtrent £100,800 aan mediese navorsingseenhede toegewys is (met uitsondering van die Pneumokoniose-Navorsingseenheid waarvan die begroting van £118,000 deur die Unie-departement van Mynwese en die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese gesamentlik gefinansier word).

## Skakelwerk

Dr. Robert M. Kark en dr. Graham, die Raad se onderskeidelike mediese skakelbeamptes in die Verenigde State van Amerika en die Verenigde Koninkryk, en prof. J. C. Middleton Shaw, die ere-skakelbeampte vir tandheelkunde in die Verenigde Koninkryk het weereens waardevolle hulp aan mediese en tandheelkundige navorsingsbeamptes verleen in verband met ontwikkelings op dié gebiede in die Verenigde Koninkryk, Europa en Noord-Amerika.

Prof. H. W. Snyman het verskillende mediese navorsingsentrums in Afrika besoek en waardevolle verbinding met navorsers in hierdie gebiede tot stand gebring.

# Medical Research

*Hon. Adviser:* PROF. S. F. OOSTHUIZEN

## Committee

The Council reconstituted its Medical and Dental Research Committee during the year as the Committee for Research in Medical Sciences, with the addition of the Director of the South African Institute of Medical Research as a permanent member.

The death of Prof. M. van den Ende of the University of Cape Town, who had served as a permanent member, was a great loss to the Committee.

Prof. H. W. Snyman relinquished membership of the Committee at the end of 1957 and, in accordance with the Committee's constitution was for one year ineligible for re-election. Dr. R. A. Alexander, Director of Veterinary Services and Dr. W. H. Craib were appointed to replace Prof. Snyman and the late Prof. Van den Ende, Prof. J. N. Coetzee and Dr. A. Kipps being appointed as alternate members in the places of Dr. Alexander and Dr. Craib.

The Council expresses its appreciation to the members of the Committee for Research in Medical Sciences and members of the medical research sub-committees for their continued interest and for their guidance on the research programmes of the medical research units and groups.

## Funds

A sum of approximately £126,450 was allocated in January, 1958, for medical and dental research during the financial year 1958/59, of which about £18,150 was allocated to medical and dental research at universities, £7,500 to the South African Institute of Medical Research, and about £100,800 to medical research units (excluding the Pneumoconiosis Research Unit where the budget of £118,000 is financed jointly by the Union Department of Mines and the Transvaal and O.F.S. Chamber of Mines).

## Liaison

Dr. Robert M. Kark and Dr. Graham, the Council's honorary medical liaison officers in the United States of America and the United Kingdom respectively, and Prof. J. C. Middleton Shaw, the honorary dental liaison officer in the United Kingdom, have continued to give valuable help to medical and dental research workers on the developments in these fields in the United Kingdom, Europe and North America.

Prof. H. W. Snyman visited various African medical research centres and established valuable liaison with research workers in these areas.



### Die Stigting van Nuwe Groepe

Die Raad het die volgende twee nuwe mediese navorsingsgroepe gedurende die jaar in die lewe geroep:

- (i) Die Voeding- en Tandheelkundige Navorsingsgroep onder die leiding van prof. C. L. de Jager, en
- (ii) die Navorsingsgroep vir die Ondersoek van die Dieet en Stofwisseling met betrekking tot Kardio-vaskulêre siektes by Gevangenes, onder die leiding van dr. P. J. Kloppers.

### Mediese Navorsingseenhede en -Groepe

Die verslae van die hoofde van die mediese navorsingseenhede en -groepe word in die volgende rubrieke gegee.

Die bystand van staats- en provinsiale owerhede, die Suid-Afrikaanse Instituut vir Mediese Navorsing, die universiteite en persone wat meegehelp het met hierdie werk, word hierby met dank erken.

## AMEBIASE-NAVORSINGSEENHEID

*Hoof van die Eenheid:* DR. R. ELSDON-DEW

Die verslagjaar was gekenmerk deur grootskaalse bedrywigheid as gevolg van die toekenning wat die Eenheid van die Verenigde State se Gesondheid diens ontvang het. Dié toekenning het ook 'n uitbreiding in personeel moontlik gemaak en daar word ook 'n aansienlike uitbreiding in die omvang van die werksaamhede beoog.

Die Direkteur het in Mei 1957 sy private praktyk opgegee en kon sedertdien al sy tyd aan die werk van die Eenheid bestee.

Hierdie toename in werksaamhede het aanleiding gegee tot 'n gebrek aan geskikte huisvesting veral wat die huisvesting van diere betref, en daar is dan ook 'n beroep gedoen op belanghebbende liggeme om hulle bystand te verleen by die oprigting van 'n gebou wat onder die naam van Instituut vir Parasitologie bekend sal staan. Skenkings ten bedrae van meer as £30,000 is reeds ontvang en daar word verwag dat die totale boukoste vir dié Instituut naby die £40,000 sal beloop. Planne is reeds opgetrek en die Provinsiale Administrasie van Natal het 'n bouterrein beskikbaar gestel net aan die suidekant van die Mediese Skool in Umbiloweg in Durban. Die bouterrein is binne maklike bereik van die Koning Eduard VIII Hospitaal wat groot hoeveelhede kliniese materiaal ter beskikking van die Eenheid stel.

Daar was talryke besoekers van oorsee soos o.a. dr. Paul Beaver, professor in parasitologie aan die Universiteit van Tulane, wat vier maande by die Eenheid deurgebring het. Daar word verwag dat dit die begin van 'n uitruilskema van personeel tussen sommige Amerikaanse opleidingsinrigtings en die Eenheid sal inlui, wat natuurlik vir beide groepe tot voordeel sal strek.

### Establishment of New Groups

The Council established the following two new medical research groups during the year:

- (i) the Nutrition and Dental Health Research Group, under the leadership of Prof. C. L. de Jager, and
- (ii) the Prison Research Group on Diet and Metabolism relating to Cardio-vascular Disease, under the leadership of Dr. P. J. Kloppers.

### Medical Research Units and Groups

Reports by the Heads of the medical research units and groups are given in the succeeding sections.

The assistance of governmental and provincial authorities, the South African Institute for Medical Research, Universities and individuals who have co-operated in this work is gratefully acknowledged.

## AMOEBIASIS RESEARCH UNIT

*Head of the Unit:* Dr. R. ELSDON-DEW

The year under review was one of considerable activity following the grant made to the Unit by the United States Public Health Service. This grant has meant the employment of more personnel and a very much wider field of activities is contemplated.

The Director retired from private practice in May of 1957 and has, since that time, been able to devote his entire time to the work.

This increased activity has brought about a lack of appropriate accommodation, particularly in the housing of animals and an appeal has been made to interested bodies to assist with the erection of a building to be known as The Institute of Parasitology. Donations now amount to over £30,000 and it is anticipated that the building will cost some £40,000. Plans have been prepared and the Administration of the Province of Natal have made a site available immediately to the south of the Medical School in Umbilo Road in Durban. This site is handy to King Edward VIII Hospital which provides a large amount of clinical material for investigation for the Unit.

There have been numerous visitors from overseas, including Dr. Paul Beaver, Professor of Parasitology in the University of Tulane, who spent four months with the Unit. It is anticipated that this will mark the beginning of an exchange of personnel between some of the American Schools and the Unit, which can only be of advantage to both parties.



### Navorsingsprojekte

Studies i.v.m. die invloed van verskillende geneesmiddels op die verloop van amebiasis word voortgesit veral met die oog op 'n vermindering van die terugvalsyfer. Hoewel die hoë sterftesyfer aansienlik verminder is, kom daar nog steeds gevalle van terugval voor. Verdere navorsing veral in verband met ekstra-lumenale amebadodende geneesmiddels moet voortgesit word. Onderzoekwerk is gedoen ten opsigte van dié geneesmiddels wat by amebiese lewerabsesse doeltreffend is, en daar is gevind dat emetien wat gewoonlik gebruik word, nog maar altyd die mees geskikte geneesmiddel blyk te wees, hoewel medikamente soos chloroquine as hulpmiddels gebruik kan word.

Die bilharzia-opname wat verlede jaar begin is, is nou voltooi en ons kan daarmee volstaan om te sê dat hoewel bilharzia baie algemeen in hierdie gebied voorkom, dit tog nie tot ernstige siektegevalle aanleiding gegee het nie.

'n Opname van die parasiete van die ingewande by werkers van 'n plaaslike fabriek het getoon dat die verskaffing van 'n toereikende proteïendieet blykbaar die voorkoms van protooëparasiete verminder, maar dit het geen invloed op die voorkoms van die wurms nie. Die wurmlas wat plaaslike Naturelle met hulle rondra is inderdaad aansienlik. Die gewone rondewurm is in meer as 60 persent van die gevalle teëgekom terwyl die sambokwurm in 100 persent van die gevalle gevind is. Laasgenoemde wurm is in die verlede as nie-patogeen beskou, maar by party van die gevalle het ons sulke groot wurmlaste opgemerk dat 'n mens hier al van 'n ernstige disenterie kan praat. Daar skyn 'n moontlikheid te wees dat besmetting met hierdie wurm een van die ontketenaars in die akute amebiasis is. Daar sal nog baie navorsingswerk in verband met die wurmlas van die naturel gedoen moet word, want dit ly geen twyfel nie dat dié verskynsel sy gesondheid ernstig verswak wat op sy beurt ook sy industriële produktiwiteit nadelig moet beïnvloed.

Heelwat sukses is behaal met die tegniek om amebes van lewerabsesse te isoleer en daardeur is dan ook 'n bron van onbesmette amebes vir verskillende rigtings van navorsing oopgestel. Ons is nou in staat om amebes saam met deur onself uitgesoekte simbioëte te kweek en ons het metodes ontwikkel waarvolgens ons die simbioëte willekeurig kan wissel. As gevolg van die toepassing van hierdie metode is gedurende die jaar die belangrike ontdekking gemaak dat daar ten minste twee amebes bestaan wat 'n identiese morfologie as dié van *Entamoeba histolytica* het. Een van hulle met die naam *Entamoeba hartmanni* is nie-patogeen en was glo in die verlede verantwoordelik vir 'n aansienlike aantal foutiewe diagnoses. Hierdie vasstelling het tot 'n heeltemal nuwe oriëntasie in die benadering van die siekte gelei en dit verklaar ook gedeeltelik hoekom so 'n groot aantal mense wat skynbaar draers van *Entamoeba histolytica* is, hoegenaamd geen simptome toon nie. Dit is egter klaarblyklik nie die end van die saak nie.

### Research Projects

Study of the effect of various drugs on the course of amoebiasis are being continued, particularly with a view to reducing the relapse rate. Though the previously high mortality has been considerably reduced, there is still a proportion of cases which relapse. Further study, particularly in respect of extra-luminal amoebicidal drugs must be continued. Investigations have been carried out on the drugs which are effective in amoebic liver abscess and it has been found that the commonly used emetine is still the drug of choice, though such drugs as chloroquine can be used as adjuvants.

The bilharzia survey started last year has been completed and it suffices to say that although bilharzia is extremely prevalent in the area, it does not seem to be responsible for much in the way of grave disease.

A survey of the intestinal parasites of workers in a local factory revealed that the provision of an adequate protein diet apparently reduced the incidence of protozoal parasites, but does not have any effect on the incidence of the worms. The worm load carried by the local Natives is very considerable, the common roundworm being found in over 60 per cent, and the whipworm in almost 100 per cent. This latter worm has, in the past, been considered non-pathogenic, but some of the cases we see have such enormous loads that there is a grave dysentery. It seems possible that infestation with this worm may be one of the trigger factors in the acute amoebiasis which we encounter. A lot of work must be done on the helminth load of the Natives for there can be little doubt that this constitutes a drain on their health which must be reflected in their industrial productivity.

The technique of the isolation of amoebae from liver abscesses has proved very successful and has provided a source of uncontaminated amoebae for research work in various directions. We are now able to grow the amoebae together with symbionts of our own choice and have developed techniques for changing the symbionts at will. Arising from this technique, the important discovery was made during the year that there are apparently at least two amoebae having the identical morphology to *Entamoeba histolytica*. One of these which has been named *Entamoeba hartmanni* is non-pathogenic and must, in the past, have been responsible for a considerable amount of misdiagnosis. This observation has meant a new orientation in the approach to the disease and may in part explain why such a large proportion of people who are apparently carrying *E. histolytica* show no symptoms at all. It is obvious, however, that it is not the whole story.

Experimental work on the purification of antigens for use in blood tests was continued and it is becoming apparent that the antigen-antibody reaction is by no means simple and that there are many factors involved. Work on this aspect will be continued.



Proefwerk in verband met die suiwering van antigene vir die gebruik in bloedtoetse is voortgesit, en dit begin al hoe meer blyk dat die antigeentestofreaksie alles behalwe eenvoudig is en dat baie faktore daarby betrokke is. Navorsingswerk oor hierdie aspek word voortgesit.

Daar word gehoop dat wanneer die gebou opgerig word daar voldoende ruimte vir die huisvesting van diere sal wees sodat dieetproewe uitgevoer kan word om die uitwerking van die dieet op die vatbaarheid vir die siekte te bepaal. Die feit dat die indringingsmeganisme in 'n sekere verband moet staan met die bakterieëflora is reeds deur die sukses van die antibakterieëterapie by die behandeling van suiwer koloniese amebiase bewys en deur sy onvermoë om die gevalle te genees waarby die amebes geskei is van hulle bakterieë soos in 'n lewerabses. Die sukses van *Clostridium perfringens* as simbioot in ons monobakteriese kulture dui daarop dat sommige organismes van hierdie tipe dalk wel 'n rol hierin kan speel, en daar word dan ook met navorsingswerk begin om hierdie punt op te helder.

#### NAVORSINGSEENHEID VIR VIRUSSIEKTES DEUR ARTOPODE OORGEDRA

*Hoof van die Eenheid:* DR. JAMES GEAR

Die werk van hierdie eenheid word behartig deur 'n span navorsers onder die leiding van dr. K. C. Smithburn en R. H. Kokernot, senior amptenare van die Rockefeller-stigting, in samewerking met personele van die Suid-Afrikaanse Instituut vir Mediese Navorsing. Die doelwit van hulle ondersoek is om die omvang van die vraagstukke in verband met die siekte by mense en diere veroorsaak deur virusse deur artropode oorgedra, in Suidelike Afrika te bepaal.

Gekoördineerde laboratorium- en veldondersoek in verband met deur artropode oorgedra virusse is deur hierdie span voortgesit met die gesamentlike finansiële ondersteuning van die Suid-Afrikaanse Instituut vir Mediese Navorsing, die Poliomiëlitis-navorsingstigting, die W.N.N.R. en die Rockefeller-stigting in samewerking met die Unie-departement van Gesondheid en die Afdeling Veeartsenykunde van die Departement van Landbou.

Reise is onderneem na Kroonstad en die Middelburg-district van Oos-Kaapland om uitbrekings ter plaatse te ondersoek. Die werk in Kroonstad het gelei tot die isolering van 'n stam van die Wesselsbronsvirus van 'n siek lam op 'n plaas waar daar twee troppe skape was waarvan daar slegs een tekens van besmetting met die Wesselsbronsiekte getoon het. Hierdie interessante epizoötiologiese verskynsel verdien om verder nagevors te word.

Daar is met ondersoekwerk in die Middelburggebied begin ten einde die vektors van die besmettings met die Wesselsbronsvirus wat daar voorkom te bepaal. Twee

It is hoped that when the building materialises, adequate animal accommodation will become available for dietetic experiments to determine the effect of diet on susceptibility to the disease. That the mechanism of invasion is in some way tied up with the bacterial flora has already been shown by the success of anti-bacterial therapy in the treatment of the purely colonic amoebiasis and its failure to cure those cases in which the amoebae are separated from their bacteria as in liver abscess. The success of *Clostridium perfringens* as a symbiont in our mono-bacterial cultures indicates that some organism of this type may well play a part and studies are being initiated to investigate this point.

#### ARTHROPOD-BORNE VIRUS DISEASES UNIT

*Head of the Unit:* DR. JAMES GEAR

The work of this Unit is carried out by a team headed by Dr. K. C. Smithburn and Dr. R. H. Kokernot, senior staff members of the Rockefeller Foundation, in collaboration with members of the staff of the South African Institute for Medical Research. The purpose of their investigations is to define the extent of the problems of human and animal disease created by arthropod-borne viruses in Southern Africa.

Co-ordinated laboratory and field investigations on arthropod-borne viruses were continued by this team under joint financial support of the South African Institute for Medical Research, the Poliomyelitis Research Foundation, the Council for Scientific and Industrial Research, and the Rockefeller Foundation, with the collaboration of the Union Health Department and the Veterinary Division of the Department of Agriculture.

Field trips were made to investigate outbreaks of illness at Kroonstad and in the Middelburg District of the Eastern Cape Province. The work at Kroonstad resulted in the isolation of a strain of Wesselsbron virus from a sick lamb on a farm where there were two flocks of sheep, only one of which exhibited infections with Wesselsbron disease. This interesting epizoötiological phenomenon merits further study.

The studies in the Middelburg area were initiated in order to determine the vectors of Wesselsbron virus infections occurring there. Two of our workers became infected with this virus while the field studies were in



van die werkers is tydens die veldwerk besmet en die virus is van hulle geïsoleer. Nogtans is daar in die loop van hulle werk en die laboratoriumwerk in verband daarmee 5 stamme van hierdie virus van lammers en 18 van muskiete geïsoleer. Die vernaamste vektor wat deur hierdie isolasies en eksperimentele oordragte verkry is, was van *Aedes caballus*, maar 3 van die isolasies is van *Aedes* (*Banksinella*) sp. gedoen. Nog sestien virusstamme is van muskiete geïsoleer wat in die Middelburgstreek gevang is, nl. 15 van *Aedes caballus* en een van *Aedes* (*Banksinella*) sp. Hierdie stamme se inkubasietydperk was taamlik kort—in teenstelling met die van die Wesselsbronnvirus—en was blykbaar identies. Hulle verteenwoordig 'n nuwe virusspesies en hy is Middelburgvirus genoem. Neutraliseringsproewe het getoon dat die mens en die skaap deur dié virus in die veld besmet raak. Isolasiëproewe en daaropvolgende eksperimente toon dat die Middelburgvirus in die veld ten minste in sekere gevalle deur *Aedes caballus* oorgedra kan word.

Veldproewe op 'n langtermynbasis is voortgesit by die veldstasie in Ndumu in Noord-Natal. Veertien virusstamme wat altesaam vier verskillende virusspesies verteenwoordig is van materiaal wat daar versamel is, geïsoleer: een van die bloed van 'n siek persoon, een van die bloed van 'n bosluisoël en 12 van muskiete. Dié virus wat van die siek persoon geïsoleer is, het die oorsaak van sy siekte geblyk te wees, en dit is dan ook die eerste stam van die Bunyamwera-virus wat nog ooit van 'n natuurlik besmette mens geïsoleer is. Twee stamme van dieselfde virus is van *Aedes circumluteolus* geïsoleer wat op daardie tydstip gevang is.

Die virus wat van die bosluisoël geïsoleer is, is maar eens in November verkry en is nog nie geïdentifiseer nie. Twee artropode-isolate wat op dieselfde tydstip gemaak is, is ook nog nie geïdentifiseer nie. Die 10 stamme wat van artropode geïsoleer en tot dusver geïdentifiseer is, sluit in: 3 Bunyamwera-, 2 Middelburg-, 4 Wesselsbronn- en een Simbustam. Die natuurlike gashere van laasgenoemde virus is nog nie bekend nie; immunologiese studies het egter aangetoon dat die eersgenoemde drie virusstamme almal sowel die mens as huisdiere besmet.

Twee van die Ndumu-isolate is in die koudste en droogste tyd van die jaar gemaak. Dit kan miskien verklaar word deurdat daar by die muskietvangste op klein gebiede gekonsentreer is wat vermoedelik 'n hoë endemisiteit het. Vyf isolasies van muskiete vroeg in die somer kan miskien ook hieraan toegeskryf word. Een van die isolasies in November is van *Culex univittatus* gedoen, 'n spesies wat tevore nog nie as gasheer of virusvektor in Suid-Afrika bewys is nie. Een van die winterisolate het van *Aedes albocephalus* gekom, ook 'n spesies wat nog nie tevore as gasheer of vektor van enige virus genoem is nie.

Daar is dus virusse van altesaam 55 stamme in drie verskillende provinsies van die Unie geïsoleer. Ses-en-veertig van die isolasies is van muskiete gedoen en daar was 6 verskillende artropodespesies daarby betrokke (en

progress and the virus was isolated from one of them. Nevertheless, their efforts and the related laboratory work resulted in the isolation of 5 strains of this virus from lambs, and 18 strains from mosquitoes. The principal vector was shown by these isolations and by experimental transmission to be *Aedes caballus*, but 3 of the isolations were from *Aedes* (*Banksinella*) sp. Sixteen other strains of virus were isolated from mosquitoes caught in the Middelburg area, 15 from *A. caballus* and one from *Aedes* (*Banksinella*) sp. These agents were of short incubation, in contrast to Wesselsbronn virus, and were apparently identical. They represent a new viral species which has been named Middelburg virus. Neutralization tests have shown that man and sheep are attacked by this agent in nature. The isolations and subsequent experiments indicate that Middelburg virus can be and is, in nature, on certain occasions at least, transmitted by *Aedes caballus*.

Field studies on a long-term basis were continued from the field station at Ndumu in Northern Natal. Fourteen strains of virus representing four different viral species were isolated from materials collected there: one from the blood of a sick human being, one from the blood of a cattle egret and 12 from mosquitoes. The virus isolated from the sick person was shown to be the cause of his illness, and represents the first strain of Bunyamwera virus ever recovered from a naturally infected human being. Two strains of the same virus were isolated from *Aedes circumluteolus* caught at this time.

The virus isolated from the cattle egret was obtained only in November and has not yet been identified. Two arthropod isolates from the same time have not yet been identified. The 10 isolated from arthropods thus far identified include 3 strains of Bunyamwera, 2 of Middelburg, 4 of Wesselsbronn, and one of Simbu virus. The natural hosts of the latter agent are not yet known, but immunological studies indicate that the former 3 agents each attack both man and domestic animals.

Two of the Ndumu isolations were accomplished in the driest and coldest part of the year. This may have been possible as mosquito catches were concentrated in small areas believed to be of high endemicity. Five early summer isolations from mosquitoes may also be attributed to this. One of the November isolations was from *Culex univittatus*, a species not previously proved to be a host or vector of virus in South Africa. One of the winter isolations came from *Aedes albocephalus*, a species never before implicated as host or vector of any virus.

Viruses to the total of 55 strains were thus isolated in three provinces of the Union. Forty-six of the isolations were from mosquitoes and 6 different arthropod species were involved (one never before being implicated). One strain was from a wild bird, 6 (all Wesselsbronn virus) were from lambs, and two Wesselsbronn and Bunyamwera were from human beings.



daarvan is nog nooit tevore as gasheer of vektor genoem nie). Een stam is van 'n wilde voël, 6 (almaal van die Wesselsbronnvirus) van lammers en twee (Wesselsbronn en Bunyamwera) van mense geïsoleer.

'n Ekspedisie na Mosambiek is onderneem om bloedmonsters van mense vir opnames van immuniteit teen virusse te maak en om die fauna van bekende of potensiële artropodevektors te verken. By die reëling in verband met die ekspedisie en die eintlike uitvoering daarvan het die navorsingspan puik samewerking van 'n aantal Portugese amptenare gehad. Daar is op 29 bewoonde plekke versamelings gemaak. Die 870 bloedmonsters verkry, word tans met behulp van 'n aantal deur artropode oorgedrae virusse getoets en daar word baie interessante en insiggewende resultate verkry. Dit is natuurlik vanselfsprekend dat baie van die virusse deur artropodes oorge-dra wat in die Unie voorkom, ook in Mosaambiek aangetref sal word. Die entomologiese versamelings verskaf inligting waardeur na verwag word korrelasies met betrekking tot die verspreiding van virussiektes gevind sal kan word.

By die weefselkultuurafdeling van die Eenheid is 'n verskeidenheid kulture van soogdier- en voëlselle gekweek en daarna is virusse op dié kulture oorgeplant. Aansienlike sitopatogeniese veranderinge is deur Bwambakoors-, Bunyamwera- en Wesselsbronnvirusse veroorsaak. Die eersgenoemde twee virusse het blykbaar vir wit muise in patogenisiteit afgeneem terwyl hulle in die weefselkulture gekweek is. Studies in verband met die antigeniese vermoë van sulke virusse wat by weefselkulture aangepas is, word tans beplan met die oog op hulle moontlike gebruik as entstof.

## BILHARZIA-NAVORSINGSEENHEID

*Hoof van die Eenheid:* DR. B. DE MEILLON

Navorsing in die Unie in verband met bilharziosis, ondersteun deur die Wetenskaplike en Nywerheidsnavorsingsraad en die Suid-Afrikaanse Instituut vir Mediese Navorsing, word deur die Departement Dierkunde aan die Potchefstroomse Universiteit, die Suid-Afrikaanse Instituut vir Mediese Navorsing in Johannesburg en die Navorsingstasie vir Bilharzia te Nelspruit, uitgevoer.

### Departement Dierkunde aan die Potchefstroomse Universiteit

Hier word die lewensstelsel en verspreiding van Suid-Afrikaanse soetwaterslakke bestudeer. Die werk word nie tot die oordraers van bilharziosis beperk nie, maar omvat alle soetwaterslakke, waarvan baie ook van groot belang vir die veeartsenykunde is. Hierdie werk word deur dr. A. J. van Eeden behartig, met geldelike ondersteuning van die Wetenskaplike en Nywerheidsnavorsingsraad. Die doel van hierdie werk is om alle Suid-Afri-

An expedition was made to Mocambique to collect blood specimens from human beings for surveys of antiviral immunity, and to survey the fauna of known or potential arthropod vectors. In arranging for and carrying out this expedition the team enjoyed the whole-hearted co-operation of a number of Portuguese officials. Collections were made in 29 populated localities. The 870 blood specimens obtained are presently being tested against a number of arthropod-borne viruses, and interesting and informative results are being obtained. It is obvious that many of the arthropod-borne viruses occurring in the Union are active also in Mocambique. The entomological collections furnish further information on which it is hoped to establish correlations with the distribution of virus diseases.

In the tissue culture section of the Unit various lines of mammalian and avian cells were propagated, and when these were established, viruses were introduced into the cultures. Noteworthy cytopathogenic changes were induced by Beamba fever, Bunyamwera and Wesselsbronn viruses. The former two agents apparently suffered loss of pathogenicity for white mice while being grown in the tissue cultures. It is planned to undertake studies of the antigenic potency of such tissue-culture adapted virus with a view to its possible use as a vaccine.

## BILHARZIA NATURAL HISTORY UNIT

*Head of the Unit:* DR. B. DE MEILLON

Bilharziasis research in the Union, which is supported by the Council for Scientific and Industrial Research and the South African Institute for Medical Research, is being carried out at the University of Potchefstroom, Department of Zoology, the South African Institute for Medical Research in Johannesburg and the Bilharzia Research Station, Nelspruit.

### University of Potchefstroom Department of Zoology

Here the fresh water snails of South Africa, their systematics and distribution are studied. The work is not confined to the vectors of bilharziasis but deals with all fresh water snails, many of which are also of great veterinary importance. Dr. A. J. van Eeden is in charge of this work, in which he is supported financially by the C.S.I.R. Its aim is to identify all South African snails and



kaanse slakke te identifiseer en om hul verspreiding te bepaal. Hierdie kennis is noodsaaklik vir ekologiese studies en vir uiteindelijke bestryding.

#### **Die Suid-Afrikaanse Instituut vir Mediese Navorsing**

Die Bilharzia-navorsingseenheid is in hierdie Instituut gehuisves waar basiese navorsing in verband met bilharziosis by proefdiere en ook by die mens wanneer die geleentheid hom voorgedoen het, reeds 'n aantal jare uitgevoer is. Die werk is toegespits op 'n beter begrip van die diagnose, patologie, terapie en morbiditeit van die siekte, sowel as van die immuniteit daarteen.

Proefnemings in verband met die invloed van 'n dieet met 'n lae proteïengehalte op bilharzia by muise is gedurende die onderhawige tydvak voleindig. Net soos by alle ander siektes is dit ook by bilharziosis 'n belangrike aspek. Die uitslag van hierdie werk was in sekere opsigte nogal verbasend. Eerstens is bewys dat die verwekking van bilharziosis by muise wat reeds aan 'n gebrek aan proteïen ly, die sterftesyfer verhoog hoewel dit geen histologiese letsels veroorsaak nie; tweedens, dat die wurms self nogal ernstig ly ten gevolge van die gebrek by die gasheer; en derdens dat gebrekkige muise blykbaar beter as muise op volle dieët in staat is om die eiers wat in hul weefsels gelê word, te vernietig. Een belangrike gevolg van die eksperiment is die feit dat tenminste sommige van die vereistes wat die wurms betref, in die lewende gasheer bestudeer kan word. Iets omtrent die fisiologiese en voedingsvereistes van die wurms het op hierdie wyse bekend geword. Hierdie vereistes is absoluut noodsaaklik vir 'n betere begrip van die siekte en 'n rasonale benadering van die behandeling daarvan.

#### **Bilharziosis en Biologiese Reaksie**

Bilharziosis veroorsaak by proefdiere merkwaardige letsels wat in die lewer soms kwaai is. Die doel hier is om uit te vind hoe die siek dier as 'n biologiese eenheid aangetas word—of sy energie deur die bilharziosis ondermyn word; of hy minder aantel; of hy minder in gewig toeneem, ens. Daar is min bekend in verband met hierdie sake ten spyte van hul geweldige ekonomiese belang. 'n Kleiner gewigstoename en 'n verswakking van die vermoë om hul kleintjies tot die speenstadium groot te maak is die enigste sigbare uitwerking wat by muise gevind is.

#### **Diagnose**

In baie gevalle is diagnosering nog 'n probleem. Daar is die ou chroniese geval wat so min eiers kwytraak dat die gewone metodes van laboratoriumondersoek hul aanwesigheid nie uitwys nie. Dan is daar die pasiënt wat slegs besmet is met 'n paar wurms, of met onvrugbare wurms of wurms van slegs een geslag. Eiers is by hulle baie skaars of heeltemal afwesig. Om dié redes is 'n vinnige en betroubare serologiese toets besonder wenslik, en hierdie aspek is reeds 'n aantal jare ondersoek. Vinnige vooruitgang is gemaak met die komplementbindings-

to find out what their distribution is, knowledge which is essential for ecological studies and for eventual control.

#### **The South African Institute for Medical Research**

In this Institute is housed the Bilharzia Natural History Unit which has for some years carried out basic research on bilharziosis in experimental animals, and also in man when the opportunity has arisen. The work is aimed at a better understanding of the diagnosis, pathology, therapy, immunity and morbidity of the disease.

During the year under review, experimental work on the influence of low protein diet on bilharzia in mice was concluded. This is an important aspect of bilharziosis, as it is in all diseases. In some ways the result of this work has been quite surprising. Firstly, it was shown that bilharziosis superimposed on a protein deficiency raises the mortality in mice but produces no severer histological lesions; secondly, that the worms themselves suffer rather severely as a result of host deficiency; and thirdly, that the deficient mice seem able to destroy the eggs laid in their tissues more readily than the mice on full diets. One important outcome of the experiments is the demonstration that some, at least, of the requirements of the worms can be studied in the living host. In this way the door has been opened to the physiological and nutritional requirements of the worms. These are obvious prerequisites for a better understanding of the disease and a rational approach to therapy.

#### **Bilharziosis and Biological Performance**

The lesions produced by bilharziosis in experimental animals are spectacular, and in liver, often severe. Here, the aim is to find out how the diseased animal is affected as a biological unit, whether its energy is sapped by the bilharziosis, whether it reproduces less, gains less weight and so on. These are matters about which there is little evidence in spite of their enormous economic importance. In mice it has been found that the only visible effects are smaller gains in weight and impairment of the ability to rear young to the weaning stage.

#### **Diagnosis**

Diagnosis still presents a problem in many instances. There is the old chronic case who passes so few eggs that these escape ordinary methods of laboratory investigation. Then there is the patient infected with only a few worms, with sterile worms, or with worms of only one sex. In these, eggs are extremely rare, or totally absent. For these reasons some rapid and reliable serological test is highly desirable and for several years this aspect has been investigated. Rapid progress has been made with the complement fixation reaction, for which there is an



reaksie waarvoor die aanvraag steeds toeneem. Daar word gehoop om met die hulp van 'n ervare seroloog wat sedert kort sy samewerking verleen, verdere tegniekverfynings te verkry.

Dogenoemde werk vereis die instandhouding van die bilharziaparasiet by slakke en hul gashere, wat op sigself 'n aansienlike taak is.

#### **Bilharzianavorsingsfasie**

Daar is 'n groot aantal ingewikkelde faktore wat die geskiktheid van die habitat van slakke bepaal en wat nog nie volkome verstaan word nie, maar hulle is waarskynlik tog besonder belangrik omdat daar bewyse bestaan dat klein veranderings—so klein dat daar nog nie in geslaag is om hulle presies op te spoor nie—'n vorige habitat ongeskik kan maak. Om 'n voorbeeld te noem: in die Krokodilrivier se opvanggebied naby Johannesburg bevat geen van die strome wat rioolslyk ontvang, vektor-slakke nie. Die deel van die rioolslyk wat hiervoor verantwoordelik is, het nog nie aan die lig gekom by die werk wat tot dusver uitgevoer is nie.

'n Soetwaterchemikus, 'n malakoloog en 'n deelytde algoloog is tans besig met hierdie werk in Nelspruit om te probeer om noukeuriger data te versamel.

Pogings is aangewend om slakverblyfplekke uit te ken deur die chemiese en fisiese struktuur van die water en verwante fauna te bestudeer. Sekere aspekte van hierdie werk waaromtrent in 1955 by die Wêreldgesondheidsorganisasie se konferensie te Brazzaville verslag gedoen is, is deur hierdie organisasie gekies om in die Bulletin gepubliseer te word. Baie van die werk neem die vorm van 'n uitskakelingsproses aan. Daar is byvoorbeeld gevind dat gewone roetineontledings van water nie fyn genoeg uitgevoer word nie om tussen die goeie en slegte slakbroeiplekke te onderskei nie. Voordat die antwoorde gevind kan word, moet fyner metodes op die mikroskaal aangewend word. Nietemin is dit opmerkingswaardig dat die algoloog in sy voorlopige opname aangetoon het dat daar taamlik goeie bewyse bestaan dat vektorslakke met bepaalde alge verwant is; dat hulle, die algemene mening ten spyte, uitsoekerig is wat kos betref; en dat sekere alge nadelig vir die aanteel van slakke skyn te wees. Aanduidings hiervan uit ander bronne is reeds 'n hele tydjie beskikbaar en dit skyn nou taamlik seker te wees dat die gewone draadalg *Spirogyra* slakaanteling direk verhoed deur 'n onbekende meganisme, of dat sy aanwezigheid eenvoudig 'n aanduiding is van ander elemente, tot dusver nog nie ontdek nie, wat 'n ongunstige uitwerking op die slak het.

'n Belangrike funksie van die Afdeling Slakekologie is om kennis te verwerf van die habitat van slakke, ook om ander redes as alleen om bestrydingsmetodes uit te vind wat makliker aangewend kan word. Pogings word orals aangewend om water, 'n kosbare artikel, te bewaar en te beskerm. Daarom is die besoedelingsprobleem lewensbelangrik, en behoort die weekdierdoder uit die oogpunt

increasing demand. With the recent co-operation of an experienced serologist it is hoped to obtain further refinements in technique.

All the work noted above requires the maintenance of the bilharzia parasites in snails and animal hosts, in itself a considerable labour.

#### **Bilharzia Research Station**

The factors that go to make up a suitable habitat for snails are numerous, complicated and incompletely understood, but they are believed to be exceedingly important because there is evidence to show that small changes—so small that there has been failure to detect them precisely—may render a former habitat unsuitable. To give an example: in the Crocodile watershed near Johannesburg all streams receiving sewage are free of vector snails. Work so far carried out has failed to show what fraction of the sewage is responsible for this.

In order to obtain more precise information a fresh water chemist, a malacologist, and a part-time algologist are engaged in Nelspruit on this work.

Attempts have been made to identify snail habitats by studying the chemical and physical structure of the water and the associated fauna. Certain aspects of this work, reported to the World Health Organization Conference at Brazzaville in 1955, have been selected by that organization for publication in the Bulletin. Much of the work takes the form of a process of elimination. It has been found, for example, that ordinary routine analyses of water are not sufficiently refined to discriminate between good and bad breeding places for snails. Finer methods on the micro scale will have to be employed before the answers are found. It is, however, worth noting that in his preliminary survey, the algologist showed that there was fairly good evidence that vector snails are associated with particular algae; that they are, contrary to popular belief, selective feeders; and that certain algae appear to be inimical to snail breeding. Indications of the latter from other sources have been available for some time and it now seems fairly certain that the common filamentous alga *Spirogyra* either directly prevents snail breeding by some unknown mechanism, or that it is simply an indicator of other, so far undetected elements which adversely affect snails.

An important function of the Snail Ecology Section is to gain knowledge of snail habitats for reasons other than more easily applied methods of control. Water being a precious commodity, efforts are everywhere being made to conserve and protect it. The problem of pollution is therefore of prime importance, and a point to be considered is the molluscicide, from the point of view of crops, soil, drinking water and so on. From the fisheries angle it is important to know what ecological barriers are going to be raised and how the naturally occurring

van oeste, grond, drinkwater, ens., aandag te geniet. Van die visserye-standpunt is dit belangrik om te weet watter ekologiese struikelblokke sulke middels kan laat ontstaan, en wat die uitwerking gaan wees op viskos wat in die natuur voorkom. Ter wille van besuïning en doeltreffendheid moet die Afdeling Ekologie daarvoor sorg dat weekdierdoders doeltreffend en op die regte plekke, in die regte hoeveelhede en op die regte tyd gebruik word. Die Afdeling het byvoorbeeld gevind dat die meeste kopersulfaat ('n baie gebruiklike weekdierdoder) in sekere natuurlike watersoorte onmiddellik neerslaan, en derhalwe in sulke gevalle nutteloos is om slakke dood te maak. Om meer kopersulfaat by te voeg as wat die water kan bevat, is verkwisting, en as die onoplosbare neergeslane koper aanhou om in die grond op te hoop, sal dit vanselfsprekend by die boeregemeenskap heelwat besorgdheid verwek.

### Epidemiologie en Eksperimentele Beheer

Die ondersoek van die epidemiologie van 'n siekte sal heelwaarskynlik belangrike gegewens in verband met die voorkoming en bestryding daarvan oplewer. Daar word gewoonlik aangeneem dat, behalwe in sekere gebiede in die Verre Ooste, die mens die enigste gasheer is van menslike bilharziosis, en dat as die siekte onder die mens uitgeroei kan word, die kringloop verbreek sal wees. In die nabyheid van Komatipoort is daar egter gevind dat soveel as 25 persent van die mense met die bilharziawurm van beeste aangesteek is. Hierdie baie belangrike ontdekking beteken dat dierlike reservoïrgashere vir siektes by die mens ernstig oorweeg sal moet word.

Die beoordeling van kontroleprojekte vir bilharzia is moeilik, maar die uitslae van proefnemings met die weekdierdoder kopersulfaat oor 'n tydperk van minstens vyf jaar is nou gekollasioneer en het aan die lig gebring dat kopersulfaat onder die meeste omstandighede van min nut is. Besonderhede van die toestande waaronder dit egter wel goeie resultate sal oplewer, is egter ook geopenbaar. Hierdie werk het 'n lang tyd in beslag geneem om te voltooi, maar nou is dit tog bekend dat die huidige metodes 'n verkwisting van tyd en geld meebring, en dat ander tegnieke en weekdierdoders ondersoek sal moet word. Die gedrag van ander bekende weekdierdoders is deur chemici van die Eenheid bestudeer. 'n Poging is byvoorbeeld aangewend om 'n konstante konsentrasie van die bekende weekdierdoder natriumpentachloorfenaat aanhoudend in lopende kanaalwater te laat drup. Indien so 'n tegniek geslaagd was, sou dit van groot nut by die bestryding gewees het, omdat die weekdierdoder dan slegs op een plek aangewend sou moet word, wat tot heelwat besparing aan arbeid en vervoer sou lei. Maar die chemici het gevind dat natriumpentachloorfenaat in oplossing binne 'n kort afstand van die aandwendingsplek verdwyn. Ondersoek het getoon dat in die Laeveld sonlig alleen reeds voldoende was om die weekdierdoder in die water te laat opbreek en verdwyn. 'n Weekdierdoder

fish foods are going to be affected. For the sake of economy and efficiency the Ecological Section must see that molluscicides are effectively applied and that they are applied in the right places, in the right quantities, and at the right time. It has been found, for example, by the Section that in certain types of naturally occurring waters most copper sulphate (a common molluscicide), immediately precipitates out and is rendered useless for killing snails. To add more copper sulphate than the water can hold is a waste and, moreover, if the insoluble precipitated copper continues to accumulate in the soil it will become a matter of concern to the farming community.

### Epidemiology and Experimental Control

The investigation of the epidemiology of a disease is one that is most likely to yield important data on prevention and control. Except in certain areas in the Far East, it is usually accepted that man is the only host of human bilharziosis, and that if the disease can be stamped out in man the chain will be broken. Nevertheless near and around Komatipoort it has been found that as many as 25 per cent of people are infected with the bilharzial worm of cattle. This very important discovery means that animal reservoir hosts for human disease will have to be taken into serious consideration.

The assessment of bilharzia control projects is difficult, but experience with the molluscicide copper sulphate over a period of no less than five years have now been collated, and have divulged that under most conditions copper sulphate is of little value. The conditions under which it will give results have, however, also been revealed. This work has taken a long time to complete but it is at last known that present methods waste time and money and that other techniques and molluscicides must be tried. Chemists of the Unit have been watching the behaviour of other molluscicides of repute. An attempt, for instance, was made to keep a constant concentration of the well-known molluscicide, sodium pentachlorophenate in flowing canal water by constant drip. Had such a technique proved satisfactory it would have been a great help in control as the molluscicide would have been applied at only one spot, thus dispensing with much labour and transport. But the chemists found that sodium pentachlorophenate in solution disappeared within a very short distance from its point of application. Investigations disclosed that in the Lowveld waters sunlight alone was enough to decompose the molluscicide and to account for its disappearance. A molluscicide that behaved in this fashion would be of little use in South Africa. Factors



wat op dié manier reageer, sou van min waarde in Suid-Afrika wees.

'n Doeltreffende geneesmiddel en 'n goeie voorbehoedmiddel om die siekte onder beheer te bring, is faktore wat seersiker 'n belangrike rol in die toekoms sal speel. Van die twee nuwe medisyne wat op pasiënte geprobeer is, skyn die een belowend teen die urinetype, maar nie teen die dermtipe van die siekte te wees nie. Die Bilharzia-navorsingseenheid het gevind dat die tweede medisyne, hoewel dit duidelik profilakties by muise gewerk het, te giftig was vir die mens.

#### Opnames

'n Herhaling van vroeëre opnames by die Bantokinders van Schoemanskloof, Hartebeespoortdam, het getoon dat minstens 44 persent met *S. haematobium* besmet was, en nie een met dierlike schistosomae, wat in daardie gebied voorkom, nie. Hierdie dierlike schistosoma skyn te verskil van dié wat by Komatipoort gevind word en waarmee die mens maklik besmet word. Hier kom 'n mens weer te staan voor die algemene gebrek aan fundamentele kennis oor bilharziosis. Stappe word tans gedoen om die hulp van dr. R. Gönner 'n bekende helmintoloog, in te roep om die identiteit van wurms wat in verskillende diere leef, te probeer vasstel.

Die ontdekking van so 'n hoë mate van menslike besmetting by Hartebeespoortdam is sorgbarend. Die skool is naby die mond van 'n klein stroompie waar besmette vektorslakke gevind is. Vanweë die groot watermassa is dit baie moeilik om slakke in die dam self te vind maar selfs al is die eintlike slak nie daar nie, dan is daar nog niks om te verhoed dat cercariae wat in die water van die stroom tereggekom het, in die dam ingespoel word nie. Enigeen wat langs die dam loop (en daar is reeds verskeie kere gesien dat blanke kinders dit ook doen) moet inderdaad die besmette stroompie oorgaan. Daar is geen brug op hierdie plek nie en die gevaar van besmetting is daar dus groot.

### KARDIO-PULMONALE NAVORSINGSEENHEID

*Hoof van die Eenheid:* PROF. G. A. ELLIOT

Gedurende die verslagjaar het die Eenheid vir Kardio-pulmonale Navorsing hom hoofsaaklik toegelê op die studie van die longfunksie en die toepassing van longfunksietoetses by sekere algemene longkwale soos emfiseem en brongitis asook op siektetoestande wat nie primêr longkwale is nie, maar waarin die longfunksie versteur is soos vetsug en kongestiewe hartverlamming gepaard met watersug.

Die studie van die longfunksie het baie ingewikkeld geword en vereis ingewikkelde apparatuur en baie gevoelige elektroniese uitrusting wat almal gereeld gestel moet word om hulle noukeurige werking te verseker.

that will surely play an important part in the future when the disease becomes controllable, are an efficient curative drug, and a good preventative. Of the two new drugs that were tried out on human patients, one seems promising against the urinary type of the disease but not against the intestinal type. The second drug, which was found by the Bilharzia Natural History Unit to be a true prophylactic in mice, proved too toxic when tried on man.

#### Surveys

A repetition of earlier surveys of the Bantu children of Schoemanskloof, Hartebeespoort Dam, showed that no less than 44 per cent were infected with *S. haematobium* and none with animal schistosomes which are known to occur in that region. It would appear that this animal schistosome differs from that found at Komatipoort, as the latter readily infects man. Here again, the lack of fundamental knowledge which is such a common feature in bilharziosis has to be faced. Steps have now been taken to enlist the help of Dr. R. Gönner, a well-known helminthologist, in trying to solve the problem of the identity of the worms living in different animals.

The discovery of such a high rate of human infection at Hartebeespoort Dam is a matter of concern. The school is situated near the mouth of a small stream in which infected vector snails have been found. In the dam itself, because of the large bulk of water, it is very difficult to find snails, but even if they are actually absent, there is nothing to prevent cercariae shed in the water of the stream being washed into the dam. Furthermore, anyone walking along the shore of the dam (and several European children have been seen doing this) must cross the stream which is known to be infected. At this point there is no bridge and a great risk of infection obviously exists here.

### CARDIO-PULMONARY UNIT

*Head of the Unit:* PROF. G. A. ELLIOTT

During the year under review the main studies of the Cardio-Pulmonary Unit were of the function of the lung and the application of lung function tests to certain generalized disorders of the lung such as emphysema and bronchitis, and to conditions not primarily diseases of the lung but in which lung function is disordered, such as obesity and congestive heart failure with dropsy.

The study of lung function has become very complicated and necessitates complex equipment and delicate electronic recording devices all of which require regular calibration to ensure their accuracy.

### Die Inspanning by Asemhaling

Na twee tot drie jaar se eksperimentele werk is daar gedurende die afgelope jaar 'n toestel ontwikkel wat die nodige fisiese energie vir asemhaling by gesondheid, en by siekte objektief kan meet en opteken.

Dit is nou moontlik om onmiddellik en aanhoudend die alveolêre druk—d.w.s. die lugdruk in die laaste asemhalingselle van die long—dwarsdeur die asemhalingsiklus in die „Liggaampletismograaf” te meet. Die persoon op wie die eksperiment uitgevoer word, word in 'n „kas” lugdig toegesluit en met verskeie meetapparate verbind en dan word die lugdruk en -vloeï aanhoudend elektronies gemeet. Die nodige berekeninge word dan op hierdie lesings gedoen. Die apparaat by die Eenheid vir Kardio-pulmonale Navorsing is die oorspronklike model, terwyl die uitvinder vir homself 'n fyner afgewerkte apparaat vir sy eie werk by die Pneumokoniose-navorsingseenheid ontwerp het.

Hierdie apparaat is gedurende 1958 vir die roetine-bestudering van emfiseem- en silikosegevalle gebruik.

Die natuurlike elastisiteit van die long wat so belangrik is vir asemhaling, is by normale persone en by dieselfde groep longlyers, deur middel van 'n ander apparaat wat in die Eenheid vir Kardio-pulmonale Navorsing ontwikkel is, bestudeer. Hierby word die lugdruk in die borskas (gemeet met behulp van 'n lugballoon wat tot halfpad in die slukderm ingesluk word), die volume lug met elke asemhaling verbruik en die snelheid van die lugvloeï in die long met elke asemhaling gemeet.

Die apparaat is gebruik by die studie van asemhaling by hartverlamming sowel as by chroniese longkwale.

### Ander Funksies van die Longe

Longfunksietoetse, afgesien van die toetse vir die meet van die inspanning by asemhaling, is soos in die afgelope jare voortgesit. Hulle sluit studies van die longvolume, die doeltreffendheid van die longbloedsomloop en die doeltreffendheid van die suurstoftoevoer by asemhaling in.

### Die Praktiese Toepassing van Hierdie

#### Navorsingsbevindings

Terwyl die Eenheid die teorie van asemhaling bestudeer het, het hulle die teoretiese aspekte ook op verskillende maniere prakties toegepas.

'n Span vir die bestudering van behandelingsmetodes vir asemnood is saamgestel om rasonale behandelingsmetodes vir pasiënte te ontwikkel van wie die asemhalingsmeganisme om verskeie redes soos bv. poliomiëlitis, harsingbesering of aanhoudende asmatiese aanvalle (*status asthmaticus*) nie meer funksioneer nie. Veel is geleer en voortgeuitgang in behandelingsmetodes is bereik.

Een van die gevare van vetsug is swak asemhaling, wat in uiterste gevalle tot hartverlamming kan lei. Gevalle van vetsug is bestudeer met betrekking tot longfunksie en die hoop word gekoester dat 'n reeks oefeninge vir

### The Work of Breathing

After two or three years of experimentation, apparatus was perfected during the year which enables the physical energy that is needed to breathe in normal health and in diseased conditions to be objectively measured and recorded.

It is now possible to measure and record instantaneously and continuously the “alveolar” pressure, that is, the air pressure in the ultimate breathing cells of the lung, throughout the cycle of respiration in the “Body Plethysmograph”. The subject is sealed in the “box” and connected to various recording devices and a continuous record of air-flow and pressure electronically recorded, from which the necessary calculations are made. The machine in the Cardio-Pulmonary Unit is the prototype, the inventor having designed a more elegant apparatus for his work in the Pneumoconiosis Research Unit.

This apparatus was applied to routine study of cases of emphysema and silicosis during 1958.

The study of the natural elasticity of the lung, important in the work of breathing, was applied to normals and to the same group of lung disorders by another apparatus designed in the Cardio-Pulmonary Unit, whereby a continuous record is made of pressure inside the chest cavity (measured by an air balloon swallowed half-way down the gullet), of the volume of air breathed with each respiration, and of the rate of flow of air into the lung with each breath.

The apparatus was applied to the study of breathing in heart-failure as well as in chronic diseases of the lungs.

### Other Lung Functions

The tests of lung function other than those devised to measure the work of breathing, continued from previous years, and included studies of lung volume, the effectiveness of the pulmonary blood circulation, and the “ventilatory efficiency” of breathing.

### The Practical Applications of these Studies

Whilst studying the theoretical aspects of breathing, the unit applied them to practice in various ways.

A “respiratory failure therapeutic team” was established to evolve rational forms of treatment, sometimes rather radically different from the orthodox forms of treatment, of patients whose breathing mechanism failed for a variety of reasons such as poliomyelitis, injury to the brain, or continued attacks of asthma (*status asthmaticus*). Much was learned and advances in therapy were made.

One of the dangers of obesity is underbreathing, which in extreme cases may lead to failure of the heart. Cases of obesity were studied as regards lung function and it is hoped to evolve a system of re-education exercises for obese patients to allow them to re-learn how to breathe.



sulke pasiënte opgestel sal kan word om hulle te leer hoe om reg asem te haal.

Volbloedigheid (polisitemie) mag 'n bloedkwaal op sigself wees, of mag ontstaan as gevolg van chroniese longkwale. Die onderskeid tussen die twee soorte is moeilik en die behandeling verskil. Die snelheid van die reaksie van bloedvernuwing na bloedtapping in die twee gevalle is bestudeer, en die hoop word gekoester dat hierdie studie sal bydra tot die ontwikkeling van nuwe metodes waardeur die twee soorte volbloedigheid van mekaar onderskei kan word.

Die kortasemigheid by hartverlamming is met behulp van hierdie toetse bestudeer, en in samewerking met die Pneumokoniose-navorsingseenheid is 'n toets ontwikkel wat objektief die graad van fisiese ongesteldheid by hartkwale meet. Dit is veral op die huidige tydstip by die ondersoek van hartgevalle belangrik om vas te stel of hulle by chirurgiese behandeling baat sal kan vind, en om objektiewe gegewens te verkry t.o.v. die voordele wat so 'n behandeling mag inhou aangesien die onderskeiding tussen sielkundige en fisiese beterskap moeilik kan wees sonder sulke objektiewe toetse. Die bestudeerde kwale het rumatiese hartkwale (mitrale stenose) en aangebore hartkwale ingesluit.

#### 'n Studie van Hartgeruise

Die belangrikheid van sekere hartgeruise wat met die gehoorpyp gehoor en deur die fonokardiogram gemeet kan word met betrekking tot die bloedvloei van die hart, is in die laboratorium deur 'n meganiese pompapparaat wat die hart voorstel, gemeet. Hierdie pompapparaat is voorsien van uitvloeiyppe waarin kleppe met openinge van verskillende groottes, ingesluit is. As hierdie werk eers voltooi is sal dit baie kan bydra tot die bepaling van die graad van vernouing van 'n hartklep. Die neem van die besluit om op 'n vernoude hartklep te opereer, sal deur kennis van die graad van vernouing grootliks vergemaklik word.

#### Die Liggaamsvloeistof by Hoë Bloeddruk

Werk het so pas begin aan 'n studie wat laat in die verslagjaar onderneem is, nl. dié van die volume vloeistof in die bloed, in die weefsels en (deur afleiding) in die liggaamselle in gevalle van hoë bloeddruk. Dit sal op pasiënte voortgesit word voor en na hulle hoë bloeddruk deur mediese behandeling verbeter is.

Hierdie studie het betrekking op die oorsaak en die behandeling van hoë bloeddruk.

#### Die Bloedvolume na Akute Bloedverlies

Deur die gebruik van radioaktiewe chroom word die bloedvolume na ernstige bloedverlies soos bv. bloedverlies as gevolg van maagswre bestudeer. 'n Kennis van die bloedvolume help by die vasstelling van die bloedverlies, en dit kan op sy beurt weer bepaal of 'n mediese of chirurgiese behandeling toegepas moet word.

A plethora of blood (*Polychythaemia*) may be a primary blood disease or may be secondary to chronic lung disease. The distinction between these two types is difficult, and the treatment different. The rate of response of blood regeneration after blood letting in the two types of case was studied and it is hoped that this study will add to the methods which will enable the two conditions to be differentiated.

The breathlessness of heart failure was studied by means of these tests and, in collaboration with the Penumoconiosis Research Unit a test was evolved which objectively measures the grade of physical disability in heart disorders. This is particularly important today in investigating cardiac cases for suitability for surgical treatment and in obtaining objective records of the benefits that may be derived from such treatment as the distinction between psychological and physical improvement can be difficult in absence of objective tests. Diseases studied included rheumatic heart diseases (mitral stenosis) and congenital heart disease.

#### A Study of Heart Murmurs

The significance of certain heart murmurs heard stethoscopically and recorded by phonocardiogram in relation to the flow of blood from the heart was studied in the laboratory by a mechanical pump device representing the heart, with the insertion of diaphragms having various sizes of orifice, in the outflow pipes from the pump. This work when completed can lead to important advances in assessing the degree of stenosis (narrowing) of a heart valve. The decision to operate surgically on a stenosed heart valve is facilitated by knowledge of the degree of stenosis.

#### The Body Fluid in High Blood Pressure

Work has just started on a study which commenced late in the period under review namely that of the volumes of fluid in the blood in the tissues and (by inference) in the body cells in cases of high blood pressure, and will be continued on patients before and after their high blood pressure has been relieved by medical treatment. The study has a bearing on the cause and treatment of high blood pressure.

#### The Blood Volume after Acute Haemorrhage

Using radio-active chromium, the blood volume is being studied after severe haemorrhage such as haemorrhage from ulcers of the stomach. A knowledge of blood volume assists in assessing how much blood has been lost, which in turn has a bearing on whether to apply surgical or medical treatment.

### Chirurgiese Behandeling by Hartgevälle

Die Eenheid vir Kardio-pulmonale Navorsing het voortgegaan met sy studie van hartgevälle met betrekking tot hulle geskiktheid vir chirurgiese behandeling, en 'n wetenskaplike kontrole na operasie word tans uitgevoer. Heelwat van hierdie tipe werk sal deel word van roetine hospitaaldiens. Nietemin word die ingewikkelde en gevoelige apparatuur wat vir ons navorsingsprojekte noodsaaklik is, juis vir die ondersoek van sulke gevälle vereis en dit sou nie redelik wees om te verwag dat die hospitaalowerhede sulke apparaat verskaf, ten minste nie binne die volgende paar jaar nie.

### Magnesiumsulfaatbehandeling van Kroonslagaarkwale

Die Eenheid het 'n gekontroleerde studie van die uitwerking van inspuitings van magnesiumsulfaat op die simptome van kroonslagaarkwale uitgevoer en kon nie die goeie resultate soos elders gepubliseer, bevestig nie.

In al hierdie navorsingswerk was daar die noue samewerking met ander afdelings van die Universiteit soos die Afdeling Fisika, Wiskunde en Snykunde asook met die Pneumokoniose-navorsingseenheid van die W.N.N.R.

## NAVORSINGSEENHEID VIR KLINIESE VOEDING

*Hoof van die Eenheid:* PROF. J. F. BROCK

### Serum-cholesterol en Vet in die Dieet

Hoewel die belang van hierdie werk hoofsaaklik om die probleem van die kroonslagaaraandoenings draai, het die Eenheid sy aandag toegespits op die mate waarin die verskillende vette in die dieët die peil van serum-cholesterol, die samestellende fraksies van die olie wat vir die verandering verantwoordelik is, en die stofwisselingsmeganisme waardeur die veranderings plaasvind, beïnvloed.

Deur langdurige studie is vasgestel dat die serum-cholesterolkonsentrasie by die meeste pasiënte verlaag kan word deur byvoeging van verskillende onversadigde olies by die gebruikelike dieet van volwasse manspersone wat hul gewone werk verrig. Hierdie uitwerking van cholesterolverlaging bly gehandhaaf solank as die olie toegedien word, en die serumcholesterol keer terug tot sy basislyn nadat met die olietoediening opgehou is. Die meeste ander faktore wat die peil van die serum-cholesterol beïnvloed is nagegaan en die grense van spontane variabiliteit van serum-cholesterol is vir gewone werktostande vasgestel. Daarteenoor is by 'n uitgekose aantal vrywilligers met 'n lae serum-cholesterolpeil aangetoon dat die toediening van sekere versadigde vette en gehidrogeneerde olies die serum-cholesterolpeil vir

### Cardiac Cases Subjected to Surgery

The resources of the Cardio-Pulmonary Unit continued to be applied to the study of cardiac cases in regard to suitability for surgical treatment and a scientific follow-up after operation is being carried out. Much of this type of work will become part of a routine hospital service. Nevertheless, intricate and delicate apparatus that is essential for these research projects is needed for the investigation of such cases, and it would not be reasonable to expect hospital authorities to supply such equipment, anyway, within the next few years.

### Magnesium Sulphate Treatment of Coronary Heart Disease

The unit carried out controlled study of the effect of injections of magnesium sulphate on the symptoms of coronary heart disease, and was unable to confirm the published reports of its benefit.

In all these investigations there was close collaboration between this unit and other departments of the University including the Department of Physics, Mathematics and Surgery and close collaboration with the Pneumoconiosis Research Unit of the Council for Scientific and Industrial Research.

## CLINICAL NUTRITION RESEARCH UNIT

*Head of the Unit:* PROF. J. F. BROCK

### Serum Cholesterol and Dietary Fat

Although the interest of this work is centred in the problem of coronary heart disease, the Unit has concentrated on the extent to which different dietary fats influence the level of serum cholesterol, the component fractions of the oil which are responsible for the change, and the metabolic mechanism through which the changes occur.

It has been established by long-term study that in the majority of patients, serum cholesterol concentration can be reduced by the addition of a variety of unsaturated oils to the customary diet of adult males engaged in their ordinary work. This cholesterol-lowering effect is maintained for as long as the oil is administered and the serum cholesterol returns to its base line after the administration of the oil has been discontinued. The many other factors which affect the serum cholesterol level have been reviewed and the limits of spontaneous variability of serum cholesterol have been established under ordinary working conditions. Conversely, it has been shown on selected volunteers with low serum cholesterol levels that the administration of certain saturated fats and hydrogenated oils will raise the serum cholesterol level for periods up to two or three weeks.



tydperke van twee tot drie weke verhoog. Voortsetting van hierdie proefneming vir 'n langer tydperk word nie as geregverdig beskou nie. Net soos voorheen word proefekspereimente in die metabolismesaal gedoen en die resultate word dan verder oor lang tydperke op ambulante vrywilligers nage-toets. Geriewe is nou beskikbaar gestel vir voortsetting en uitbreiding van hierdie werk op pasiënte in sielsiekehospitale. Die besonderhede van hierdie dieetproefneming is goedgekeur deur die Advieskomitee van die Nasionale Voedingnavorsingsinstituut en die Kommissaris vir Geesteshigiëne.

By bestudering van die manier waarop onversadigde olies werk, het die Eenheid in die metabolismesaal aangetoon dat die galsuurafskeiding van die ontlasting aanmerklik deur sekere onversadigde olies toeneem sonder dat die ontlastingslipiede of die totale gewig van die ontlasting verander. Geen groter hoeveelheid galsuur word deur die ontlasting afgeskei nie wanneer versadigde olies toegedien word nie. Die implikasies van hierdie studie is bevestig deur 'n dergelike toename om die galsuurafskeiding aan te toon by 'n klein aantal pasiënte met galfistels wanneer onversadigde olies deur die mond ingegee word. Die bevindings is verenigbaar met die teorie dat cholesterol afgeskei word as galsuur.

Daar is toestande vasgestel waaronder die serum-cholesterolreaksie by rotte as 'n biologiese toets gebruik kan word om te bepaal watter bestanddeel van die olies vir die cholesterol-verlaging of -verhoging verantwoordelik is. 'n Voorlopige ondersoek skyn daarop te wys dat die aktiwiteit ten dele in die onverseepbare fraksie lê. Hierdie voorlopige bevindings stem skynbaar ooreen met die bewering dat sitosterol help om die serum-cholesterol te verminder. Dit is egter gevaarlik om aan te neem dat wat vir rotte geld, ook vir die mens geld, en die Eenheid se ondervinding met mense het geen verlaging van die serum-cholesterolkonsentrasie by daaglikse toediening van die onverseepbare fraksie van 100 g. sonblomolie aangetoon nie.

#### Proteïeneondervoeding

Die studie in verband met die genesing van kinders wat aan kwashiorkor ly, en die besteding van die genesing, is nog aan die gang. Die kliniese en metaboliese balans-werk word nou in die nuwe Kinderhospitaal van die Rooikruis voortgesit, waar 'n uitstekende metabolismesaal met ses bedjies en behoorlike toesig beskikbaar is. Aanvanklike werk het aan die lig gebring dat die begin van genesing 'n redelike gevoelige toets vir die proteïendoeltreffendheid van 'n formule is. Toename van die serum-albumien verskaf 'n meetbare laboratoriumkontrole. Daarenteë is dit duidelik dat die toets weens die verskil in strafheid van kliniese gevalle en in die sameval van infeksie slegs beperkte waarde het vir onderskeiding tussen die proteïendoeltreffendheid van formules wat nie baie van mekaar verskil nie. Die navorsers het hulle nou al geruime tyd daarop toegelê om addisionale laboratoriumtoetse uit te werk, wat die toets gevoeliger sal maak. Dit het geblyk dat serum-amylase en serum-cholienesterase nie gevoeliger

It has not been considered justifiable to continue this experiment for longer periods. As before, pilot experiments are carried out in the metabolism ward and the results are then further tested over long periods of time in ambulant volunteers. Facilities have now been obtained for continuation and development of this work upon patients in a mental hospital. The conditions of this dietary trial have been approved by the Advisory Committee of the National Nutrition Research Institute and the Commissioner for Mental Hygiene.

The Unit, in studying the mode of action of the unsaturated oils, has shown in the metabolism ward, that the faecal excretion of bile acid is significantly increased by certain unsaturated oils without alteration in total stool lipids or total stool weight. No increase in faecal bile acid is obtained when saturated fats are administered. The implications of this study have been confirmed by demonstrating a similar increase in bile acid excretion in a small number of patients with biliary fistula when unsaturated oils are administered by mouth. The findings are compatible with the theory that cholesterol is excreted as bile acid.

Conditions have been established under which the serum cholesterol response in rats may be used as a biological test to identify which component of the oils is responsible for the cholesterol-lowering or cholesterol-raising effect. Preliminary work has suggested that the activity may reside, in part, in the unsaponifiable fraction. These preliminary findings are apparently in accord with the claim for the efficacy of sitosterol in reducing serum cholesterol. It is dangerous, however, to argue from rat to man especially in this field, and the Unit's human experiments have shown no lowering of serum cholesterol concentration on feeding daily the unsaponifiable fraction from 100 g. of sunflower oil.

#### Protein Malnutrition

A continuing study is in progress on initiation and consolidation of cure in the child with kwashiorkor. The clinical and metabolic balance work has been transferred to the newly opened Red Cross Children's Hospital where an excellent metabolism ward with six cots and proper supervision has been provided. Early work has shown that initiation of cure is a reasonably sensitive test for the protein efficiency of a formula. Rise in serum albumin gives a measurable laboratory control. On the other hand it is clear that owing to variability in the severity of clinical cases, and in the coincidence of infection, the test has limited value in distinguishing between the protein efficiency of formulae which do not differ markedly from each other. Work has been concentrated for some time on finding additional laboratory tests which will make the test more sensitive. Serum amylase and serum cholinesterase proved to be no more sensitive than serum albumin. A large amount of data has now been accumu-

as serum-albumien is nie. 'n Groot hoeveelheid data is nou versamel i.v.m. die stikstofbalans gedurende die tydperk waarin genesing begin; al die data is nog nie klaar ontleed nie, dog wat gedoen is, skyn daarop te wys dat dit 'n verfyning sal wees, soos trouens ver wag word. Die reaksie van die serum-cholesterol skyn in sekere opsigte gevoeliger te wees as dié van serum-albumien, maar sal laasgenoemde nie vervang nie. Die moontlikheid om vollediger besonderhede te verkry deur die verdeling van stikstof in die urine en in die bloed onder ureum, aminosuur en kreatinien word deeglik nagegaan.

Vertolking van stikstofdata en aminosuuraafskeiding in die urine is in die verlede moeiliker gemaak deur die noodsaak, om ekonomiese redes, vir die gebruik van rasemiese kunsmatige aminosure. Hierdie moeilikheid is tans uit die weg geruim deur 'n milde skenking van L-aminosure deur Merck Inc. Sommige van die studies van die stikstofbalans en aminosuuraafskeiding word met suiwere L-aminosuurformules herhaal ten einde deur vergelyking met vorige gegewens te kan sê in watter mate urinêre stikstofafskeiding die gevolg van onassimileerbare D-isomere was.

Proefnemings is aan die gang om gelyk met aminosuurformules die uitwerking van formules wat heeltemal uit natuurlike plantaardige proteïene bestaan, te bepaal. Voorlopige werk dui daarop dat genesing sonder twyfel by kwashiorkor begin kan word met die gebruik van geskikte mengsels van plantaardige proteïene. Aangesien dit so is, moet die vooruitsig om proteïenondervoeding te voorkom deur diëte wat hoofsaaklik van plantaardige oorsprong is, uitstekend wees. Die biochemiese werk in verband met hierdie projek word deur dr. H. E. Schendel, wat vir vier jaar deur die Williams Waterman-fonds afgegaan is, behartig. Die aminosuurformules is in samewerking met dr. E. E. Howe van Merck Inc., Rahway, New Jersey, Verenigde State van Amerika, getoets.

#### **Proteïenondervoeding by Volwassenes**

Die eenheid het al 'n paar jaar 'n studie gemaak van die rol wat proteïenondervoeding in 'n groep gevalle speel wat in hul later stadia gelyk met chroniese oedeem ook chroniese hartverlamming en lae serum-albumien vertoon. Tans word getrag om die stikstofbalans by volwasse pasiënte wat in die vroeë stadia van proteïenondervoeding verkeer, en op verskillende dieetformules gestel word, te bepaal. Die werk is van fundamentele belang. Die eerste vraagstuk op die program is: bepaling of die groot en langdurige stikstofbehoud wat in die literatuur vermeld en deur onself by hierdie soort pasiënte bevestig is, in werklikheid 'n teken van 'n proteïentekort van groot omvang is, of anders, of dit 'n eksperimentele kunsmatige produk is. Die tweede vraagstuk is: op watter biochemiese toetse kan staatgemaak word om besonderhede aan die lig te bring omtrent die plek en die geaardheid van die proteïene-omset in die sisteem.

Terselfdertyd word getrag om gegewens te versamel oor die mate waarin meliemeel verbeter kan word as 'n

lated on nitrogen balance during the period of initiation of cure; analysis of the data is not complete but it suggests that this will be, as expected, a refinement. The response of the serum cholesterol appears to be, in certain respects, more sensitive than that of serum albumin but will not displace the latter. The possibility of obtaining fuller information by partition of nitrogen in urine and in blood between urea, amino-acid, and creatinine is being actively pursued.

Interpretation of nitrogen data and amino-acid excretion in the urine has in the past been complicated by the necessity, for economic reasons, of using racemic artificial amino-acids. This difficulty has now been overcome by a generous donation from Merck Inc. of L-amino-acids. Some of the studies of nitrogen balance and amino-acid excretion are being repeated with pure L-amino-acid formulae in order to tell by comparison with previous data the extent to which urinary nitrogen excretion resulted from unassimilable D-isomers.

Experiments are in progress to test, in parallel with amino-acid formulae, the effect of formulae made entirely from natural vegetable protein. Preliminary work indicates that without doubt, cure can be initiated in kwashiorkor by the use of suitable mixtures of vegetable proteins. This being so, the prospects for prophylaxis of protein malnutrition with diets predominantly of vegetable origin must be excellent. The biochemical work in this project has been in the hands of Dr. H. E. Schendel, seconded for a four-year period by the Williams Waterman Fund. The trials of amino-acid formulae have been done in collaboration with Dr. E. E. Howe of Merck Inc. Rahway, New Jersey, United States of America.

#### **Adult Protein Malnutrition**

The Unit has for some years studied the role of protein malnutrition in a group of cases presenting in their late stages with chronic oedema, chronic heart failure and low serum albumin. Attempts are now being made to study nitrogen balance on a variety of formulae, of adult patients in the earlier stages of protein malnutrition. The work is at a fundamental level, the first two items on the programme being firstly, to determine whether the large and long continued nitrogen retention reported in the literature and confirmed by ourselves in patients of this sort, does in reality present a protein deficit of high magnitude, or alternatively whether it is an experimental artefact; and secondly, what biochemical tests can be relied upon to give information about the site and nature of protein turnover in the system.

At the same time, information is being sought on the extent to which mealie meal can be improved as a source



stikstofbron vir die liggaam met 'n tekort aan proteïene, deur byvoeging van ander plantaardige en dierlike proteïene en van sintetiese aminosure.

### **Nefrose, Nierhomeostase en Porfirie**

Hierdie werkgebied val onder geneeskunde deur kliniese ondersoek en het indirek betrekking op hedendaagse probleme by kliniese voeding. Die twee belangrikste punte is: Elektrolietmetabolisme-homeostase by die normale en die abnormale, en porfirie en porfirien-metabolisme.

#### *Elektrolietmetabolisme*

Sover is die uitwerking van steroïedterapie in ongeveer 50 gevalle van nefrotiese sindroom bestudeer. Die ondervinding wat in verband met genesing opgedoen is, was baie minder bemoedigend as dié in Amerikaanse verslae vermeld. Die plan is om voortaan aandag aan die meganisme van diuresis te bestee, met inbegrip van die rol deur aldosteroon en baie ander steroïde gespeel.

„Chlorathiazid” is 'n nuwe veelbelowende urineermiddel vir mondelinge toediening. 'n Studie is gemaak van hoe dit werk. Die balans en nierwerking by sowel normale proefpersone as lyers aan hart-, nier- en leweroedeem is uitvoerig bestudeer.

Die natrium- en kaliumbalans in 'n geval van sporadiese periodieke verlamming is gedurende vyf maande bestudeer en Conn se bewering dat intrasellulêre sekwestervorming voor die aanval plaasvind, is bevestig. Die uitwerking van 'n hoë en van 'n lae natriumopname is bestudeer.

Niersiektes gekenmerk deur 'n kaliumverlies, en aldosteronisme is ondersoek in samewerking met die Departement van Chemiese Patologie. Daar is bewys dat die gevolgtrekking dat primêre aldosteronisme deur laparotomie uitgesluit kan word, geen steek hou nie.

#### *Porfirie en Porfirienuitskeiding*

Bepalings van delta-amino-levulienuur, porfobilinogeen, uro- en koproporfirien word uitgevoer. Veranderinge in die daaglikse urien- en fekalië-afskieding word bestudeer in sy verband met die natuurlike verloop van die aandoening en die uitwerking van terapie. Aandag word veral bestee aan die afskieding van fekale porfirien by normale persone van verskillende rasse op verskillende diëte gestel en in toestande van abnormale metabolisme. Kliniese ondervinding dek tans 80 gevalle, bestaande uit blanke, kleurling- en Bantoeprøefpersone.

#### **Ondervoeding en Homatologie**

Die Eenheid was verantwoordelik vir die bymekaarmaak van drie groepe proefpersone: normale blanke mans; blanke mans wat kroonslagartrombose gehad het; en Bantoe mans van dieselfde leeftyd regstreeks uit die natuurreserwes. Talryke aspekte van die bloedstolwerking en van fibrinolise is grondig ondersoek. Die resultate word nog statisties ontleed dog skyn op teleurstellende klein

of nitrogen for the protein depleted body by the addition of other vegetable and animal proteins and of synthetic amino-acids.

### **Nephrosis, Renal Homeostasis and Porphyruria**

This field of work falls under clinical investigative medicine and has indirect reference to current problems in clinical nutrition. The two main interests are: Electrolyte metabolism—homeostasis in the normal and the abnormal, and porphyria and porphyrin metabolism.

#### *Electrolyte Metabolism*

Up to date, the effect of steroid therapy in some 50 cases of nephrotic syndrome has been studied. Experience in respect of cure is far less encouraging than in many of the American reports. In future it is hoped to direct attention to the mechanism of diuresis, including the role of aldosterone and many other steroids.

„Chlorathiazide” is a new oral diuretic of great promise. Its mechanism of action was studied. Detailed balance and clearance studies have been conducted in both normal subjects and subjects with cardiac, renal and hepatic oedema.

Sodium and potassium balance in a case of sporadic periodic paralysis was studied over a period of five months and Conn's claim that intracellular sequestration of sodium occurs prior to the attack was confirmed. The effects of a high and of a low sodium intake were studied.

The study of potassium-losing renal disease and aldosteronism was conducted in collaboration with the Department of Chemical Pathology. The implication that primary aldosteronism can be excluded by laparotomy was shown to be fallacious.

#### *Porphyria and Porphyrin Excretion*

Estimations of delta-amino-laevulinic acid, porphobilinogen, uro- and copro-porphyrin are being carried out. The alterations in daily output (urinary and faecal) are being studied in relationship to the natural course of the disorder and the effects of therapy. Attention is being directed particularly to faecal porphyrin output in normal subjects of different races under different dietary regimes and in conditions of abnormal metabolism. Clinical experience now covers 80 cases and includes Europeans, Coloured and Bantu subjects.

#### **Malnutrition and Haematology**

The Unit has been responsible for collecting three groups of subjects: European normal men; European men following coronary thrombosis; and age-matched Bantu fresh from the Native Reserves. A very intensive study has been made of many aspects of the blood coagulation mechanism and of fibrinolysis. Results are still being submitted to statistical analysis but the trend

verskille te dui. Dit versterk die mening dat die bestaande metodes vir die ondersoek van bloedstolling, wat in noue verband met kroonslagartrombose staan, nie gevoelig genoeg is nie. By hierdie ondersoek is ook die bepaling van die mate van versadiging van die met serum-cholesterol veresterde vetsure in die drie groepe voltooi. Soos verwag is, was daar by die Bantoe 'n heelwat groter mate van onversadiging.

#### Ondervoeding en die Buislose Kliere

In samewerking met die Navorsingsgroep in verband met Buislose Kliere is 'n begin gemaak om die uitwerking van ondervoeding op die uitskeiding van kortikosteroïde te ondersoek. In die Transkei is 'n voorlopige opname van gevalle van pellagra en ander ernstige soorte ondervoeding en van gesonde en oënskynlik goedgevoede Bantoe gedoen. Die resultate word tans ontleed.

#### Konferensie

Die Hoof van die Eenheid het in Julie 1957 namens die Lipiede-afdeling van die Eenheid 'n verslag aan die Internasionale Voedingskongres in Parys gelewer. Hy het verder ook 'n bydrae gelewer aan die Afdeling Voedsel en Voeding van die Gordon-navorsingskonferensies in die Verenigde State en aan 'n simposium oor aminosuurverryking wat deur die firma du Pont de Nemours in Wilmington, Delaware, V.S.A., gereël is.

Adjunk-professor L. Eales het op versoek 'n bydrae gelewer op die Konferensie bekend as „Transactions of the Western Metabolic Conference” te Palm Springs, Kalifornië.

### NAVORSINGSEENHEID I.V.M. TAND-HEELKUNDE

*Hoof van die Eenheid:* PROF. J. T. IRVING

Net soos in die verlede het die werk van die Eenheid hoofsaaklik in verband gestaan met die vernaamste feite met betrekking tot tand- en beenvorming. Ook is 'n begin gemaak met navorsing i.v.m. die chemiese veranderinge wat in die tandvleis plaasvind.

#### Die Chemie van Verkalking

Die werk op hierdie gebied is voortgesit en uitgebrei, grotendeels in 'n poging om die verskil tussen die organiese bestanddele van sagte en van harde weefsels te bepaal. Navorsing is toegespits op die samestelling van kollageen, die vernaamste proteïene in been-, tand- en sagte bindweefsels. Nadat al die  $\epsilon$ -aminogroepe van been- en tandkollageen volkome met suur of etilediamientetraasynsuur ontkaalk was, het hulle chemies met dinitrofluorobenseen gereageer, terwyl slegs ongeveer die helfte van dié van bindweefsels gereageer het. Dit het moontlik gelyk dat die nie-reagerende  $\epsilon$ -aminogroepe van die

is towards disappointingly small differences. This fortifies the view that existing methods for the study of blood coagulation, as it underlies the problem of coronary thrombosis, are not sensitive enough. In the same project the degree of saturation of the fatty acids esterified with serum cholesterol in the three groups has been completed. As expected, the Bantu show a considerably higher degree of unsaturation.

#### Malnutrition and Endocrines

A start has been made in collaboration with the Endocrine Research Group on investigating the effect of malnutrition on the excretion of corticosteroids. A preliminary survey was made in the Transkei of cases of pellagra and other severe malnutrition compared with healthy and apparently well nourished Bantu in the same area. The results are at present being analysed.

#### Conferences

A communication was made by the head of the Unit on behalf of the Lipid Section of the Unit to the International Nutrition Congress in Paris in July, 1957. He subsequently contributed to the Food and Nutrition Section of the Gordon Research Conferences in the United States and to a Symposium on amino acid enrichment organized by Messrs. du Pont de Nemours at Wilmington, Delaware, United States of America.

Associated Professor L. Eales contributed by invitation to the Conference entitled “Transactions of the Western Metabolic Conference” at Palm Springs, California.

### DENTAL RESEARCH UNIT

*Head of the Unit:* PROF. J. T. IRVING

As in previous years the work of the Unit was mainly concerned with the fundamental processes of tooth and bone formation. Research was also started into the chemical changes that occur in the gingiva (gums).

#### Chemistry of Calcification

Work in this field continued and was extended, largely in an endeavour to determine the difference in the organic components of soft and hard tissues. Research centred on the composition of collagen, the chief protein of bone, teeth and soft connective tissue. When fully decalcified with acid or ethylene diamine tetracetic acid, all the  $\epsilon$  amino groups of bone and tooth collagen were chemically reactive with dinitrofluorobenzene, but only about half those of connective tissue were reactive. It appeared possible that the unreactive  $\epsilon$  amino groups of soft tissue collagen were combined in a peptide linkage. Thus,



kollageen van sagte weefsels in 'n peptiedbinding gebind is. Dit wil dus voorkom asof daar 'n fundamentele verskil tussen die kollageen van sagte en van harde weefsels is, ten spyte van die feit dat hulle chemies baie eners is. Die werk is uitgebrei tot weefsels wat nog nie heeltemal verkalk was nie, kalfsbeen en dentien van rotte wat aan rachitis ly. Hierby het geblyk dat minder  $\epsilon$ -aminogroepe met die anorganiese fase „gebind” was, dog dat die binding van die orige groepe dieselfde was as in die geval van volkome verkalkte weefsels. 'n Gedeelte van die anorganiese fase was nie met die  $\epsilon$ -aminogroepe van kollageen geassosieer nie, en die ondersoek na die aard van hierdie binding is voortgesit.

#### Die Mikrochemie van Tandverkalking

Toe verkalkende weefsels met warm piridien geëkstraheer en met Soedanswart gekleur is, het geblyk dat die kleurstof slegs die weefsel wat die kortste gelede verkalk het, gekleur het. Dit was die geval by emalje en dentien, asook by<sup>7</sup>been. Die stof wat swart gekleur is, was waarskynlik 'n mukopolisakkariëd, aangesien dit 'n bekende feit is dat hierdie groep stowwe iets met verkalking te doen het. Die feit is dat hierdie groep stowwe iets met verkalking te doen het. Die feit egter dat die kleurstof slegs in sekere plekke opgeneem is, was 'n bewys dat die verbinding wat verkleur het 'n spesiale lid van hierdie klas verbindings was en waarskynlik nog nooit vantevore beskryf was nie. In die geval van rachitiese diere was daar, toe verkalking opgehou het of baie vertraag is, geen kleurbare stof in die been nie en baie min in die tande. By die toediening van genesende dosisse vitamien D, het die stowwe reeds gou weer verskyn in albei die weefsels. As gevolg van bovermelde werk is die werkers van hierdie Eenheid die mening toegedaan dat hierdie stof wat met Soedanswart gekleur kan word, onontbeerlik vir die begin van verkalking in dentien en been is en dat 'n bepaalde kollageen nodig is om die verkalking te laat voortduur.

#### Lipiedinsluitings in Tandvormende Selle

Die werk in verband met lipiedinsluitings in tandvormende selle is voortgesit. Dit het heeltemal duidelik geblyk dat hierdie insluitings nie dieselfde was nie as die „Golgi-liggampies” wat vroeër deur navorsers beskryf is, aangesien hulle anders verdeel was en anders gelyk het. Hulle het egter met die stofwisselingswerking van die selle<sup>8</sup> in verband gestaan, aangesien hul die meeste gekonsentreer was in die aktiefste selle. Die moontlikheid bestaan dat die lipied 'n deklagie op die korrels deur die sel uitgeskei, vorm—in die geval van die glasuur-sel, op die deeltjies van die stof wat voor die normale matrix vorm. Indien dit so is, sal die ondersoek van hierdie lipiedinsluitings 'n waardevolle manier wees om die vormingsweg van hierdie voorlopers van die glasuur-matrix na te gaan, wat normaalweg nie moontlik is nie.

there appeared to be a fundamental difference between the collagen of soft and hard tissues in spite of the fact that chemically they are very similar. Work was extended to less fully calcified tissues, calf bone, and dentin from rats with rickets. Here it was found that fewer  $\epsilon$  amino groups were “combined” with the inorganic phase, but that the combination of the remaining groups was the same as in fully calcified tissues. Part of the inorganic phase was not associated with the  $\epsilon$  amino groups of collagen and work is continuing to investigate the nature of this bond.

#### Microchemistry of Tooth Calcification

It was found, when calcifying tissues were extracted with hot pyridine and stained with Sudan Black, that only the most recently calcified tissue took up the stain. This applied to enamel and dentin and also to bone. The substance being stained was probably a mucopolysaccharide, as it is known that this group of substances is concerned with calcification. But the strict localization of the staining showed that the compound being stained was a special member of this class of compounds and had probably not been described before. In rachitic animals, when calcification stops or is greatly slowed, the stainable substance was absent from bone and greatly reduced in amount in teeth. If curative doses of Vitamin D were given, the substance rapidly reappeared in both tissues. Taken in conjunction with the work reported above, the workers at this Unit are arriving at the view that this Sudan Black stainable substance is essential for the initiation of calcification in dentin and bone and that a specific collagen is necessary for the maintenance of calcification.

#### Lipid Inclusions in Tooth Forming Cells

The work previously conducted on lipid inclusions in tooth forming cells was extended. It seemed quite clear that these inclusions were not the same as the “Golgi bodies or apparatus” described by earlier workers, as they had a different distribution and appearance. They were, however, associated with the metabolic activity of the cells, since they were found in highest concentration in the most active cells. It is possible that the lipid forms a covering over the granules of secretion of the cell—in the case of the ameloblast, over the particles of substance forming the precursor of the normal matrix. If this is true, the investigation of these lipid inclusions will form a valuable way of following the pathway of formation of these enamel matrix precursors, which cannot normally be visualized.

### **Dieetkundige Faktore en Tandglasuurvorming**

Die ondersoek na die invloed van vitamien E en verwante stowwe op die vorming van tandglasuur is voortgesit. Vroeëre werkers het nadruk gelê op die belangrikheid van vitamien E vir die handhawing van die pigment op 'n rot se snytande. Hierdie Eenheid het bevind dat vitamien E onontbeerlik is vir die volkome handhawing van glasuurvorming, en derhalwe moet vitamien E aan die lys van die dieetkundige faktore wat vir hierdie verskynsel absoluut noodsaaklik is, toegevoeg word. Dit is dus waarskynlik dat vitamien E noodsaaklik is vir behoorlike tandvorming by baie ander diere buiten en behalwe die rot.

Die genesende werking van dieetproteïen en van vitamien E is vergelyk by rotte met 'n tekort aan hierdie stowwe. Albei hierdie faktore het presies dieselfde uitwerking gehad en die eerste waarneembare verandering was die vroeë herverskyning van yster in die glasuur selle. By sulke proefnemings is dit belangrik dat die vetinhoud van die dieet nie te hoog is nie, en dit is moontlik dat die weersprekings in die literatuur oor vitamien E—net soos proteïenwerkings—daaraan te wyte is dat geen notisie van die dieetvetpeil geneem is nie. Hoewel proteïen vitamien E sou kan vervang by tandbeskerming, het die dialuursuurhemolisetots, wat negatief is by rotte wat met vitamien E behandel is, positief gebly in die geval van diere wat proteïen by hul kos gekry het.

Te veel vitamien A in die dieet het die werking van vitamien E ernstig gestrem.

### **„Anorganiese” Been as Inplantingsmateriaal**

„Anorganiese” been is been wat geen organiese bestanddele meer bevat nie. 'n Beesdybeen is met etileen-diamien gesuiwer en na verdere suiwering is dit aan 'n tandarts gegee as implantingsmateriaal om tandkasbeenvernuwing op plekke waar die been geresorbeer is, aan te help. Voorlopige resultate dui daarop dat hierdie materiaal in sekere gevalle 'n veelbelowende vervangingsmiddel vir homogene en outogene been is.

### **Asemhaling en Ensimologie van Tandvleis**

Die metabolisme van skaaptandvleis is ondersoek met gebruikmaking van die Warburg-mikro-asemhalingstoestel. Die ruswaardes van suurstofverbruik was dieselfde as dié vir menslike tandvleis gevind, en die weefsel het al die tussenprodukte van die Krebs siklus ('n belangrike reeks reaksies in koolhidraatmetabolisme) geoksideer. Dit is die eerste maal dat hierdie siklus volledig ondersoek is in die geval van tandvleis, en daaruit het geblyk dat die reaksies van hierdie weefsels soortgelyk is aan dié van die lewer, spiere en niere. Aangesien tandvleis 'n essensiële orgaan by die instandhouding van gesonde tande is, is ondersoek na sy biochemiese en fisiologiese werking van die grootste belang.

### **Dietary Factors and Amelogenesis**

Investigations on the influence of vitamin E and allied substances on dental enamel formation were continued. Previous workers have laid stress upon the importance of vitamin E in maintaining the pigment on the rat's incisor tooth. It was found in this Unit, that vitamin E is essential for the complete maintenance of amelogenesis and thus vitamin E must be added to the list of those dietary factors essential for this phenomenon. It would thus appear probable that vitamin E is necessary for proper tooth formation in many other animals besides the rat.

The curative actions of dietary protein and of vitamin E were compared in depleted rats. Both these factors had exactly the same effect and the first detectable change was the early re-appearance of iron in the ameloblasts. It is important in such experiments that the fat content of the diet should not be too high and it is possible that the contradictions in the literature about the vitamin-E—like actions of protein—are due to a disregard of dietary fat levels. Although protein could replace vitamin E in tooth protection, the dialuric acid haemolysis test, which is negative in vitamin E treated rats, stayed positive in animals getting protein in the diet.

Excess vitamin A in the diet grossly interfered with the action of vitamin E.

### **“Anorganic” Bone as an Implantation Material**

“Anorganic” bone is bone that has been deprived of its organic components. Ox femur was refluxed with ethylene diamine and after further purification, supplied to a dental practitioner as an implantation material to stimulate alveolar bone regeneration in areas of bone resorption. Preliminary results showed that this material had great promise as a substitute in certain cases for homogeneous and autogenous bone.

### **Respiration and Enzymology of the Gingiva**

The metabolism of sheep gingiva was investigated, using the Warburg micro-respiration apparatus. The resting values of oxygen consumption were the same as those found for human gingiva and the tissue oxidized all the intermediates of the Krebs cycle (an important series of reactions in carbohydrate metabolism). This is the first time that this cycle has been completely investigated in the case of gingiva and shows that the reactions of this tissue are similar to those of liver, muscle and kidney. Since the gingiva is an essential organ in the maintenance of the health of the tooth, investigations of its biochemical and physiological activities are of fundamental importance.



## ENDOKRIEN/METABOLISME NAVORSINGSGROEP

*Leier van die Groep:* PROF. F. FORMAN

Die werk is in hoofsaak voortgesit in verband met prediabetes, die mineraalbalans by verstuurings van kalsiummetabolisme en spesiale endokrienskattings.

### Diabetes

Prediabetes of latente diabetes kan deesdae tydens swangerskap herken word. Maar kan dit ook nog op 'n ander wyse as deur swangerskap vasgestel word? Aangesien swangerskap met oormatige werking van die byniere gepaard gaan, is die glukosetoleransie geneem vóór en na die persone met kortisoon behandel is. Verskeie groepe is ondersoek: normale kontrolepersone van verkillende leeftye, swanger vroue sonder 'n familiegeskiedenis van diabetes, verdagte prediabetici (op grond van hulle swangerskapsgekiedenis of vroeëre „prediabetiese” toleransiekurwes), verdagte prediabetici wat swanger was, persone met diabetes in 'n geringe graad en persone wat vanweë hulle familiegeskiedenis waarskynlik self prediabeties was. Die resultate het getoon dat die kortisoon/glukosetoleransietoets nie betroubaar is as hy negatief is nie.

Vergrote pankreaseilande by doodgeboortes beteken diabetes of prediabetes (as *erythroblastosis foetalis* buite rekening gelaat kan word). Die pankreas van 88 onuitgesoekte doodgeboortes is ondersoek. By 18 is vergrote eilande vasgestel. Twaalf moeders van babas met vergrote eilande is nagespoor en daarvan het 10 abnormale glukosetoleransiekurwes getoon. Party van hulle het sedertien duidelik diabetes geword. Prediabetes van die moeder se kant kan „onverklaarbare” doodgeboortes veroorsaak.

Normale „prediabetiese” en diabetiese vroue is ondersoek ten einde die uitwerking van swangerskap op die glukosetoleransiekurwe, plasmakortisol, eosinofiele en plasmafosfor vas te stel. Tot dusver is daar maar min verskil tussen die drie groepe opgemerk vir sover dit die laaste drie ondersoekte betref.

Daar is beweer dat by swanger diabetici die werking van die byniere selfs nog groter is as die welbekende toename gedurende die laaste drie maande van normale swangerskap. Die Cushingoïde-voorkoms van die pasgebore babas van diabetiese moeders bevestig hierdie hipotese. Plasmakortisol en die urinêre afskeiding van ketosteroïede en hidrokortikoïede is op opeenvolgende dae tydens verskillende swangerskapsmaande bepaal.

Chirurge in verskillende dele van die wêreld het die hipofise of die byniere verwyder by ernstige veranderings van die retina by diabetes, en daar het glo 'n verbetering ingetree. Daar is beweer dat die oormatige werking van die byniere 'n rol daarby speel. Vyf-en-twintig diabetes-pasiënte met komplikasies van die retina en dieselfde

## ENDOCRINE/METABOLIC RESEARCH GROUP

*Leader of the Group:* PROF. F. FORMAN

In the main, work has continued on prediabetes, mineral balance studies in disorders of calcium metabolism and special endocrine estimations.

### Diabetes

Pre- or latent diabetes can today be recognized during pregnancy. Can it be brought to light apart from pregnancy? Since the state of pregnancy is associated with excessive adrenal activity the glucose tolerance was performed before and after the individuals were given cortisone. Several groups were examined—normal controls of varying ages, pregnant women without diabetic family histories, suspected prediabetics (from their obstetric histories or previously “prediabetic” tolerance curves) suspected prediabetics who were pregnant, mild diabetics and subjects whose family histories made it likely that they were themselves prediabetic. The results showed that the cortisone/glucose tolerance test is not reliable when negative.

Enlarged pancreatic islets in stillbirths mean diabetes or prediabetes (if erythroblastosis foetalis can be excluded). The pancreas of 88 unselected stillbirths were examined; 18 were found to have enlarged islets. Twelve mothers of babies with enlarged islets were traced and 10 of these were demonstrated to have abnormal glucose tolerance curves. Some have since become frankly diabetic. Maternal prediabetes may cause “unexplained” stillbirths.

Normal, “prediabetic” and diabetic women have been followed to observe the effect of pregnancy on the glucose tolerance curve, the plasma cortisol, eosinophils and plasma phosphorus. Thus far there seems little difference between the three groups as far as the last three investigators are concerned.

It has been suggested that pregnant diabetics have even greater suprarenal activity than the well-known increase during the last three months of normal pregnancy. The Cushingoid appearance of the newborn infant of diabetic mothers lends support to this hypothesis. Plasma cortisol and urinary excretion of ketosteroid and hydrocorticoids were estimated on consecutive days at various months of pregnancy.

Surgeons in several parts of the world have removed the pituitary gland or the suprarenals for severe retinal changes in diabetes. Improvement has been claimed. It has been suggested that suprarenal overactivity plays a part. Twenty-five diabetic patients with retinal complications and a similar number without are being studied from this aspect.

getal daarsonder word tans met die oog op hierdie aspek bestudeer.

Tweehonderd-en-vyftig agtereenvolgende diabetici by die diabeteskliniek word tans bestudeer met besondere inagneming van hulle retinale, hart- en senuweekomplikasies.

'n Kliniekproef met tolbutamied (D 860), 'n diabetes-teenmiddel vir mondelinge toediening, is op 250 diabetici uitgevoer en daar is heelwat interessante gegewens verkry. By die maer pasiënte met suikersiekte in 'n geringe graad was die teenmiddel besonder doeltreffend. Die oorskakelingsmetode van insulien wat in hierdie studie toegepas is, het die aandag op 'n aantal diabetici gevestig wat nóg insulien nóg tolbutamied nodig gehad het.

#### Kalsium- en Fosformetabolisme

Die wyse waarop die niere kalsium en fosfor hanteer is by normale en by siektetoestande waarby die kalsium en fosformetabolisme versteur is, bestudeer.

Die reaksie van normale persone teenoor parathormone is bestudeer. Sestien normale proefpersone het aan hierdie projek deelgeneem en 200-800 eenhede is binne 3-7 dae toegedien. Daar is daagliks urinêre en serumkalsium- en fosforbepalings gedoen. Elke toets is voorafgegaan deur twee kontroledae. Daar is vasgestel dat slegs 50 persent van die gevalle gereageer het en dat die vermindering in die fosfor die dag wanneer daar 'n styging in serumkalsium plaasgevind het, voorafgegaan of op dieselfde dag plaasgevind het.

Kalsium-, fosfor-, kalium- en stikstofstudies is by 'n aantal siektetoestande gedoen waar hierdie stowwe gewoonlik abnormaal is. Die siektetoestande het onder andere inbegryp sarkoïede, osteomalasie, rachitis bestand teen vitamien D, idiopatiese hiperkalsiuria, 'n ernstige graad van Paget se siekte en akromegalie. Die uitwerking van vitamien D by verskillende dosisse, van natriumfitaat en kortisoon is ondersoek. By sarkoïdose is daar gereken dat in die gevalle met abnormaliteite in die kalsiummetabolisme die kalsium in 'n buitensporige mate deur die derm geabsorbeer word, dat nóg 'n lae kalsiuminname nóg fitaat die hiperkalsiuria sal uitwis, dat daar 'n veranderlike oormatige sensitiwiteit teenoor vitamien D bestaan en dat kortisoon die abnormale stofwisselings-toestand sal genees.

'n Aantal normale plattelandse Bantoe persone is bestudeer om hulle metaboliese reaksie op 'n hoë kalsiumdieet, op bygevoegde kalsium en op sterk dosisse vitamien D te bepaal. Die uitwerking van kortisoon op die metaboliese reaksie op vitamien D is dopgehou aangesien daar beweer is dat kortisoon 'n „anti-vitamien-D” is. Sover as wat ons proefnemings getoon het, blyk dit dat kortisoon hoegenaamd nie D-veroorsaakte hiperkalsiuria verminder nie maar dit inderdaad nog laat toeneem.

#### Funksie van Buislose Kliere by Ondervoeding

Dit was die doel om die funksie van die hipofise en die byniere by pasiënte met pellagra en ander vorms van ondervoeding te bepaal.

Two hundred and fifty consecutive diabetics at the diabetic clinic are being studied with special reference to retinal, cardiac and nerve complications.

A clinical trial of tolbutamide (D 860), an oral anti-diabetic remedy, was carried out on 250 diabetics. Several interesting results were obtained. The *thin* mild diabetics were a group in which the drug was specially valuable. The method of changeover from insulin adopted in this study brought to light a number of diabetics who needed neither insulin nor tolbutamide.

#### Calcium and Phosphorus Metabolism

The handling by the kidney of calcium and phosphorus was studied in normal and in diseased states in which calcium and phosphorus metabolism is disturbed.

The response of normal persons to parathormone was studied. Sixteen normal subjects took part in the project and 200-800 units were given over 3-7 days. Daily urinary and serum calcium and phosphorus determinations were made. Each test was preceded by 2 control days. It was found that only 50 per cent of cases had a response, and that lowering of the phosphorus preceded or occurred on the same day as a rise in serum calcium.

Calcium, phosphorus, potassium and nitrogen studies were made in a number of diseased states in which these are usually abnormal. These included sarcoid, osteomalacia, vitamin D-resistant rickets, idiopathic hypercalciuria, severe Paget's disease and acromegaly. The effect of vitamin D in varying dosage, of sodium phytate and cortisone was investigated. In sarcoidosis it was established that in those cases with calcium metabolic abnormalities calcium is overabsorbed from the gut, that neither a low calcium intake nor phytate will abolish the hypercalciuria, that there is a variable excessive sensitivity to vitamin D and that cortisone will cure the abnormal metabolic state.

A number of normal rural Bantu subjects were studied to assess their metabolic response to a high calcium diet, to added calcium, and to high dosage vitamin D. The effect of cortisone on the metabolic response to vitamin D was observed since it has been claimed that cortisone is "anti-vitamin D". So far our experiments indicate that cortisone so far from diminishing D-induced hypercalciuria, actually increases it.

#### Endocrine Function in Malnutrition

The object was to assess pituitary and adrenal function in patients with pellagra and other forms of adult malnutrition.



Tien pellagragevalle is by die Sir Henry Elliott Hospitaal in Umtata bestudeer. Urine- en serummonsters is teruggebring Kaapstad toe. Die studie word tans nog voortgesit.

#### Kliniese Endokrinologie

Ondersoeke van pasiënte met tipes gonadale disgenese en ander afwykende geslagspatrone is voortgesit. Benaamde die gewone studies is 'n heeltemal nuwe gebied ontsluit deur die vermoë om die genetiese geslag deur middel van die selkerne van die vel, leukosiete en ander weefsels te kan onderskei.

### HARTNAVORSINGSEENHEID

*Hoof van die Eenheid:* PROF. H. W. SNYMAN

Tuberkulose perikarditis word nog bestudeer om die uitwerking van operasies te bepaal. Die kenmerkende drukkpatroon wat verkry word tydens die siekte word vergelyk met dié wat na die operasie ontwikkel.

Die waardebeplanning van ventrikelhipertrofie word nagegaan. Hiervoor word vier maatstawwe gebruik, naamlik die fisiese betasting, die elektrokardiografiese en röntgenologiese beelde en die gewig van die hart soos bepaal deur die patoloog-anatoom.

Dit blyk uit 'n ontleding van die groep kongenitale harte wat hier ondersoek is, dat 26 uit 72 gevalle bo 20-jarige leeftyd en selfs nog 14 bo 30-jarige leeftyd was, dit wil sê, byna 20 persent van die totale aantal ondersoek. Die ontleding wys dus daarop dat selfs op volwasse leeftyd die aangebore foute nog as oorsake van hartaandoenings erken moet word.

Die besondere drukverhoudings van die atrioventrikulêre kleppe en hulle bydrae tot die ontstaan van geruise oor die hart sal met 'n nuwe instrument deur die hospitaal verskaf, grafies ontleed kan word.

Etlike vaatonomalieë by die atria is gevind en ontleed. Daar bly steeds 'n groep hartaandoenings waarvan die veroorsakende faktore nog nie vasgestel is nie. Hierdie interessante en belangrike gebied staan ook onder die soeklig.

In die hospitaal is 'n begin gemaak met die ontleding van die voorkoms van rumatiesse hartaandoenings; die bedoeling is om 'n prognostiese studie daarvan onder die Bantoe- en blanke groepe uit te werk.

Publikasies is voorberei in verband met: Abnormale vaatonomalieë by die atrium, drukstudies in verband met geruise by trikuspidalis-stenose, die prikkelbaarheid van die hartspier by die Bantoe.

Ten cases of pellagra were studied at the Sir Henry Elliot Hospital at Umtata. Urine and serum specimens were brought back to Cape Town. The study is still under way.

#### Clinical Endocrinology

Investigation of patients with types of gonadal dysgenesis and other vagaries of sexual pattern has continued. In addition to the usual studies a completely new field has been opened up by the ability to tell the genetic sex from the nuclei of the cells of the skin, leucocytes and other tissues.

### HEART RESEARCH UNIT

*Head of the Unit:* PROF. H. W. SNYMAN

Tuberculous pericarditis is still being studied with the object of determining the effect of operations. The characteristic pressure pattern obtained during the disease is compared with that which develops after the operation.

The evaluation of ventricular hypertrophy is being investigated. Four standards are used for this purpose, viz., physical palpation, electro-cardiographic and X-ray plates and the weight of the heart as determined by the pathologist-anatomist.

It has become apparent from the analysis of the group of congenital hearts examined here, that 26 out of 72 cases were more than 20 years of age and that another 14 were even more than 30, that is to say approximately 20 per cent of the total number examined. The analysis therefore shows that even when adult age has been reached, congenital defects must still be recognized as causes of heart diseases.

The particular pressure ratios of the atrioventricular valves and their share in causing murmurs over the heart, can now be analysed with the aid of a new instrument supplied by the hospital.

Several vascular anomalies at the atria were found and analysed. A group of cardiac diseases still remain, however, the causative factors of which have not yet been established. This interesting and important field is also being investigated.

A start has been made at the hospital with an analysis of the incidence of rheumatic cardiac disease, the object being to work out a prognostic study among the Bantu and the European groups.

Publications have been prepared in connection with: abnormal vascular anomalies at the atrium, pressure

Deur middel van kateterstudies word gereelde tegniese metings by die pasiënte uitgevoer. Lede van die Departement Kindergeneeskunde neem soms aan hierdie studies deel. Gereelde besprekings deur die groep word gehou met die oog op ontleding van die gegewens en daarna word besprekings gehou met die chirurge indien operasies nodig geag word. Die beurshouer het verder die besondere opdrag om die rumatiesee aandoenings na te gaan. Hiervoor is 'n skema uitgewerk gebaseer op die internasionale standaarde vir die kliniese bepaling van die siekteproses.

Die Eenheid het 'n oksimeter met kuvet geïnstalleer met behulp waarvan suurstofversadiging deurlopend bepaal kan word. Die tegniese assistent was besonder gemoeid om die Van Slyke-apparaat herstel te kry om te gebruik in 'n ykingsmetode vir die oksimeter. 'n Apparaat wat deur die hospitaal verskaf is, sal ook tot navorsingsgeriewe bydra. Dit is 'n opvangtoestel op vier kanale, waarmee fonokardiografiese, elektrokardiografiese en drukgrafieke gelyktydig geregistreer kan word. 'n Verdere voordeel van hierdie besondere instrument is dat dit 'n onmiddellike grafiek beskikbaar maak.

Ander apparaat deur die Eenheid verkry, sluit in 'n poliviso vir registrasie van drukke, 'n drukgeleier (Hathaway), 'n elektriese motor vir die posisionering van die deurligtingsapparaat, en 'n tydsmeter vir beskerming teen oormatige bestraling.

#### NAVORSINGSEENHEID VIR MENSLIKE BIOCHEMIE

*Hoof van die Eenheid:* DR. A. R. P. WALKER

##### Oorsese Besoek

Die Hoof van die Eenheid het gedurende die tydperk Februarie-September 1957 wat hy oorsee deurgebring het, verskeie navorsingsentrums in die V.S.A., Kanada, Brittanje en op die Vasteland besoek. Hierdie besoeke is finansiële deur die W.N.N.R. en indirek deur die Academy of Science, New York, moontlik gemaak.

Blykbaar ontbreek dit nie aan oorsese belangstelling vir die gesondheidsbeeld van die Suid-Afrikaanse Bantoe nie, grotendeels weens die seldsame voorkoms van kroon-slagtaarsiekte onder hulle. 'n Verslag oor die onlangse vordering wat verskillende aspekte van voeding, en siektes betref, word opgestel.

Besoeke van langer duur is aan sekere bevolkingsgroepe in Arizona (die Navajo-Rooihuide), Athene, Istanboel en Israel gebring. Party daarvan is deur die plaaslike Ernest Oppenheimer Navorsingseenheid vir Hartbloedvatsiektes moontlik gemaak. Interessante inligting in verband met hartsiektes wat aan die lig gekom het, het getoon dat

studies in connection with murmurs in the case of tricuspidalis stenosis, the irritability of the cardiac muscle in the Bantu.

By means of catheter studies regular measurements are carried out on patients. Members of the Department of Pediatrics sometimes take part in these studies. Regular discussions are held by the group with an eye to analysis of the data and discussions are afterwards held with the surgeons in case operations are deemed necessary. The holder of the fellowship has been entrusted with the special task of studying rheumatic diseases, and for this purpose a scheme has been worked out, based on the international standards for the clinical determination of the course of the disease.

The Unit has installed an oxymeter fitted with a cuvette, by means of which oxygen saturation can be continuously determined. The technical assistant was particularly active in getting the Van Slyke apparatus repaired for use in calibrating the oxymeter. An apparatus supplied by the hospital will also facilitate the research. This is a four-channel receiving set by means of which phonocardiographic, electrocardiographic and pressure graphs can be simultaneously recorded. A further advantage of this particular instrument is that it provides a direct graph.

Further apparatus acquired by the Unit include a polyviso for recording pressures, a pressure conductor (Hathaway), an electric motor for positioning the X-ray apparatus, and a timer for protection against excessive irradiation.

#### HUMAN BIOCHEMISTRY RESEARCH UNIT

*Head of Unit:* DR. A. R. P. WALKER

##### Overseas Visit

During the period February to September, 1957, spent overseas by the Head of the Unit, visits were made to various research centres in U.S.A., Canada, Britain and the Continent. These visits were made financially possible by the C.S.I.R. and, indirectly, by the New York Academy of Science.

There appears to be no lack of interest overseas in the health picture of the South African Bantu, this being in large part due to the rarity of mortality from coronary heart disease among them. A report, bearing on recent advances in various aspects of nutrition and disease is being prepared.

More protracted visits were made to certain population groups in Arizona (Navajo Indians), Athens, Istanbul, and Israel, certain of these visits being facilitated by the local Ernest Oppenheimer Research Unit for Cardiovascular Disease. Interesting items of information bearing on heart disease that came to light, revealed that among the Navajo Indians, the mildness of aortic ather-



slagaarverharding onder die Navajo-Rooihuide in 'n baie ligte graad voorkom en kroonslagaartrombose baie seldsamer is as wat 'n mens sou verwag op grond van hulle groot vetinname (hoofsaaklik dierlike vet) wat na skatting sowat 20-25 persent kalorieë verskaf. Kroonslagaarsiekte kom minder in Athene as in Istanboel voor en die sterftesyfer is ongeveer wat 'n mens by hulle dieet sou verwag. Hierdie betreklik hoë sterftesyfer in Istanboel (en selfs vir die platteland van Turkye) kom voor ten spyte van 'n aktiewe dog nie merkbaar sensuslopende bestaan nie. In Israel kom daar onder immigrante uit Asië en Afrika wat tog aan 'n betreklik hoë inname van plantaardige olies gewoond is, min strawwe aterosklerose voor, en is die aantal sterfgevälle aan kroonslagaarsiekte ook laag. En dog na 'n paar jaar in die nuwe land waar die verandering in die dieet 'n vetinname insluit, wat hoofsaaklik uit dierlike en gehidrogeneerde vette bestaan, is die immigrante net so vatbaar vir die siekte as inheemse Israelis onder wie dit die vernaamste sterfte-oorsaak is. Hierdie vinnige verandering is die teenoorgestelde van die verskynsel wat hom tydens die oorlog in sekere Skandinawiese lande voorgedoen het, waar dit onder andere met 'n vermindering van die vetinname in die dieet in verband gestaan het. Waarnemings het aan die lig gebring dat ander voedselbestanddele as vet ook 'n vervettingsrol speel en dat ander faktore as dieet ook so 'n uitwerking het. 'n Verslag word vir publikasie opgestel.

#### **Suigelingssterftesyfer**

Hoë syfers vir suigelingssterftes en morbiditeit kom in wisselende mate by die meeste volke op aarde voor. Na aanleiding van sy besoek aan sekere lande in die Midde-Ooste is die Hoof van die Eenheid besig om die sterftesyfers te vergelyk vir doodgebore kinders, kinders onder 'n maand en effens ouer kinders onder plaaslike en oorsese bevolkingsgroepe in uiters verskillende omstandighede (ten opsigte van dieet en ander faktore). Dit is reeds duidelik dat voedingdeskundiges miskien te geneig is om foutiewe voeding aan te neem as die oorwegende invloed in toestande waar die sterftesyfer onder suigelinge hoog is.

#### **Swangerskap, Melkvorming en die Ontwikkeling van die Kind onder die Bantoe**

Voortspruitende uit die Hoof van die Eenheid se besoek aan die Navorsingseenheid vir Verloskunde en die Mediese Navorsingsraad onder prof. Dugald Baird aan die Universiteit van Aberdeen, skyn die tyd nou gunstig te wees om 'n duideliker beeld van die Bantoe te verkry as wat op die oomblik bestaan wat betref die verband tussen voeding en die reaksies op swangerskap, die soogprestasie en die ontwikkeling van die kind. Voorlopige werk word voortgesit in verband met die versameling van verslae wat reeds deur klinieke en ander inrigtings in sekere stedelike en plattelandse sentrums gehou is en die bepaling van die waarde daarvan. Erkenning van die superioriteit van die Bantoe in sekere opsigte sal dien om

osclerosis, and extreme rarity of coronary thrombosis, are less than what would be expected from the fat intake (largely animal) estimated to supply roughly 20-25 per cent of calories. Coronary disease in Athens is lower than in Istanbul, mortality being such as would be predicted approximately from the diet consumed. This relatively high mortality in Istanbul (and even in rural Turkey) obtains despite an active but not noticeably nerve-wracking existence. In Israel, immigrants from Asia and Africa, although accustomed to a moderately high vegetable oil intake, have little severe atherosclerosis and the death rate from coronary disease is low. Yet after a few years in their new country, where dietary changes include fat intake composed largely of animal and hydrogenated fats, immigrants become as susceptible to the disease as indigenous Israelis, among whom it is the leading cause of death. This rapid change is the converse of the phenomenon noted in certain war-time Scandinavian countries and associated, *inter alia*, with reduction in dietary fat intake. Observations clearly indicate an atherogenic role in food components other than fat, and also in factors other than diet. A report is being prepared for publication.

#### **Infantile Mortality Rate**

Among the bulk of the earth's population, high rates for infantile mortality and morbidity occur to a varying degree. Consequently on his visit to certain Middle East countries, the Head of the Unit is making a comparison of data on rates of still-birth, neo-natal, and post neo-natal mortality among local and overseas population groups in widely different contexts (dietary and non-dietary). It is already apparent that nutritionists are perhaps too prone to accept faulty nutrition as the predominating influence under conditions where high infantile mortality rates prevail.

#### **Pregnancy, Lactation, and Infant Development in the Bantu**

Arising from the visit of the Head of the Unit to the Medical Research Council Obstetric Medicine Research Unit under Professor Dugald Baird at Aberdeen University, the time seems opportune to obtain a much more definite picture of the Bantu than is at present known in respect of the relevance of nutrition to reactions to pregnancy, performance in lactation, and development of offspring. Preliminary work on collecting and assessing the value of records already being kept by clinics and other institutions at certain urban and rural centres is in progress. Recognition of the superior behaviour of the Bantu in a number of respects will serve to show the more



'n beter perspektief van soortgelyke studies van 'n meer intensiewe aard wat oorse uitgevoer is, te kry. In sekere opsigte soos bv. voedingsvereistes tydens swangerskap en die soogtyd sal hersiening van die ortodokse leer in verband met hierdie onderwerpe nodig wees.

#### **Studies in Verband met die Ystermetabolisme van die Bantoe**

Soos reeds in baie vorige verslae gemeld, is die beeld van die ystermetabolisme van die Suid-Afrikaanse Bantoe (wat deeglik deur hierdie Eenheid ondersoek is), buitengewoon interessant, ten eerste weens hulle hoë ysterinname (in 'n groot mate van hul gereedskap vir kosbereiding afkomstig) en ten tweede omdat daar dikwels 'n abnormale ysterafsetting in hul organe en weefsels aanwesig is. Aandag word tans geskenk aan studies in verband met serumyster en die verhoudings organiese en anorganiese yster in die Bantoe se kossoorte.

Ten einde meer lig te werp op die invloed van ouderdom, geslag, voedings- en ander toestande, en op die absorpsie van yster uit 'n hoë ysterinname word 'n studie in verband met die yster in die bloedserum van die betrokke Bantoe en blanke proefpersone onderneem, waarby anorganiese soute en allerlei kossoorte van die Bantoe as bron van die element gebruik word.

Weens verskille in die graad van absorpsie van verskillende ysterbindings is gereken dat dit die moeite werd is om die relatiewe hoeveelhede organiese en anorganiese yster in voedselsoorte te ondersoek wat deur die Bantoe met behulp van hul gewone gereedskap nl. kafferpotte, paraffienblikke en erdepotte berei word.

#### **Voorkomssyfer van Diabetes Mellitus onder die Bantoe**

Dit ly geen twyfel nie dat plaaslike onsekerhede omtrent hierdie siekte dringend 'n noukeurige bepaling van die voorkomssyfer vereis. Werk met dié doel voor oë is reeds aangepak. In samewerking met dr. H. C. Seftel van die Hospitaal vir Nie-Blankes te Baragwanath is 'n program opgestel waarvolgens dr. Seftel die Johannesburgse Bantoe in stedelike woonbuurtes sal bestudeer, terwyl die Navorsingseenheid vir Menslike Biochemie van plan is om die posisie wat betref die Bantoe wat in die myne werk en dié wat op die platteland woon, te ondersoek. Studies word in die eerste plek beperk tot die bepaling van die voorkoms van suiker in die urine waarby die „toetsbandtegniek” toegepas word.

#### **Diverse**

Die Hoof van die Eenheid het in Maart 1957 op uitnodiging van die New-Yorkse Academy of Science deelgeneem aan 'n konferensie in New-York in verband met voeding, en 'n lesing gehou oor „Sekere biochemiese bevindings by die mens met betrekking tot die dieet”. Hy het gebruik gemaak van gegewens, hoofsaaklik uit sy eie studies in verband met die Bantoe verkry, en beklemtoon hoe sorgvuldig daar onderskei moet word

intensive corresponding studies carried out overseas in better perspective. In certain respects at least, namely, nutritional requirements in pregnancy and lactation, a revision of the orthodox teaching on these subjects will be necessary.

#### **Studies on the Iron Metabolism of the Bantu**

As mentioned in many previous reports, the iron metabolism picture of the South African Bantu (which has been extensively investigated by this Unit) is unusually interesting on account of their very high iron intake (derived in large measure from their food preparation utensils), and also on account of the frequent presence of abnormal iron deposition in their organs and tissues. Studies now receiving attention are serum iron studies and the proportions of organic and inorganic iron in Bantu foodstuffs.

In order to throw more light on the influence of age, sex, nutritional state and other conditions, on the absorption of iron from high iron intakes, appropriate serum iron studies on the relevant Bantu and white subjects are being undertaken, using inorganic salts and various Bantu foodstuffs as the sources of the element.

On account of differences in degree of absorption of various iron compounds, it has been considered worthwhile to investigate the relative proportions of organic and inorganic iron in foodstuffs prepared by Bantu using their usual utensils, “Kaffir pots”, paraffin cans, and earthenware vessels.

#### **Incidence of Diabetes Mellitus in the Bantu**

Local uncertainties concerning this disease leave no doubt that a more accurate appraisal of its incidence is urgently required, and work to this end has been initiated. In association with Dr. H. C. Seftel of Baragwanath Non-European Hospital, a programme has been drawn up in which Dr. Seftel is studying the Johannesburg Bantu dwelling in urban townships, while the Human Biochemistry Research Unit is planning to investigate the position as it affects Bantu mineworkers and rural dwellers. In the first instance, studies are being confined to the determination of the incidence of sugar in the urine, using the “Tes-tape” technique.

#### **Miscellaneous**

At the invitation of the New York Academy of Science, in March, 1957, the Head of the Unit took part in a nutrition conference in New York and read a paper entitled “Certain biochemical findings in man as they relate to diet”. Using data drawn mainly from his own studies on the Bantu, he emphasized the careful discrimination required before accepting biochemical and



voordat biochemiese en ander abnormaliteite onder hierdie mense as iets absoluut patologies aanvaar word.

'n Vergadering wat drie dae duur, word in Maart 1958 deur die Endokrinologiese Navorsingskomitee van die V.S.A. te Brighton, Utah, gehou. Die Hoof van die Eenheid is as afgevaardigde uitgenooi en het 'n verhandeling opgestel oor „Sekere aspekte van die endokrienbeeld van die Suid-Afrikaanse Bantoe—'n bevolking waaronder betreklik min sterfgevallen aan kroonslagaaraandoening voorkom”. Die eerste deel van die verhandeling bestaan uit 'n opsomming van die navorsingswerk wat in Suid-Afrika gedoen is, in verband met arteriosklerose en kroonslagaaraandoenings. Verder word verslag gedoen omtrent plaaslike waarnemings in verband met lewersiektes en -abnormaliteite en moontlike komplikasies ('n verhoogde estrogeen en lae 17-Ketosteroidafskiedings, ginekomastie, ens.).

Ten slotte word 'n poging aangewend om die mate van „beskerming” te bepaal wat hierdie moontlike reeks ontwikkelings verleen binne die wye raamwerk van die „beskerming” wat die dieet en die lewenswyse van die Bantoe bied.

## VOEDINGNAVORSINGEENHEID

*Hoof van die Eenheid:* PROF. J. GILLMAN

### Voeding, dieet en tumors

Proefnemings vir die bepaling van die uitwerking van drie verskillende diëte op die voorkoms van kanker by meer as 1,000 rotte is nou voltooi. Dit het duidelik geblyk dat die dieet in staat is om die uitbreek van verskillende soorte siektes te verhaas of te vertraag, veral nier- en hartsiektes asook tumors van die buislose kliere met inbegrip van die harsingslymklier, die skildklier en die byniere. Dit word benadruk dat hierdie tumors spontaan ontwikkel in teenstelling met tumors wat eksperimenteel en met behulp van bekende chemikalieë veroorsaak word. Bogenoemde proefnemings het ook getoon dat sommige diëte sekere soorte kanker geheel en al strem terwyl ander weer 'n aansienlike toename in dieselfde soorte kanker teweegbring. Hierdie inligting is nogal belangrik vir 'n beter begrip van die omvang van die voorkoms van kanker by die verskillende etniese groepe in verskillende dele van die wêreld.

### Vitamiën A

Ondanks die feit dat vitamien A een van die eerste ontdekte vitamienes was en as absoluut lewensnoodsaaklik bekend staan, weet ons bra min oor sy gedrag in die liggaam. Binne die raamwerk van 'n algemene program van studie in verband met die rol van vitamien A is 'n radio-aktiewe vorm van hierdie verbinding deur 'n baie

other abnormalities in these people as essentially pathological.

In March, 1958, the Endocrinological Research Committee of the U.S.A. Public Health Service is holding a three day meeting at Brighton, Utah. The Head of the Unit has been invited as a delegate and has prepared a paper dealing with “Certain aspects of the endocrine picture of the South African Bantu,—a population relatively free from mortality from coronary artery disease”. The first part of the paper provides a summary of research work done in South Africa on atherosclerosis and coronary heart disease among the Bantu. An account is later given of local observations on liver disease and abnormality, and possible complications (elevated estrogen and low 17-Ketosteroids excretions, gynaecomastia, etc.). Finally, an endeavour is made to assess the quota of “protection” afforded by this possible sequence, within the wider framework of the “protection” afforded by the Bantu type of diet and manner of life.

## NUTRITION RESEARCH UNIT

*Head of the Unit:* PROF. J. GILLMAN

### Nutrition, diet and tumours

Experiments designed to examine the effects of three different diets on the incidence of cancers in over 1,000 rats have now been concluded. It is evident that diet is capable of promoting or retarding the onset of several different kinds of disease, notably kidney and heart disease, as well as tumours of the endocrine glands, including the pituitary, thyroid, and adrenal. It is emphasized that these tumours are spontaneous in origin in contrast to tumours produced experimentally with the aid of known chemical agents. The above experiments have also shown that some diets are capable of suppressing, completely, certain kinds of cancers whereas others lead to a high incidence of the same cancers. This information is not without some importance for the understanding of the frequency of cancer in the various ethnic groups in different parts of the world.

### Vitamin A

Despite the fact that vitamin A was one of the earliest vitamins discovered and is known to be indispensable for life, little is known about its mode of action in the body. As part of a general programme to learn more about the role of vitamin A, a radioactive form of this compound has been synthesized by a very able chemist



bekwame skeikundige in die laboratorium gesintetiseer. Hierdie radio-A kan in minimale hoeveelhede in die bloed en in die weefsels bepaal word en nadat dit toegedien is, kan sy bewegings in die bloed en die weefsels gevolg word.

Voorlopige ondersoekte het aan die lig gebring dat vitamien A deur 'n besondere proteïen in die bloed gedra word. Hierbenewens is daar tans studies aan die gang om die faktore te bepaal wat die beweging van vitamien A in en uit die lewer beheer. In hierdie verband behoort daar vermeld te word dat vitamien A as 'n aanduidingsmiddel gebruik is om die invloed van mak-making op die liggaamsfunksies van die bobbejaan aan te toon. Dit het geblyk dat hoewel 'n verhoging van vitamien A in die dieet die vitamien-A-gehalte in die bobbejaan se lewer laat styg—'n feit wat vantevore by ander diere vasgestel is—'n volgehoue voeding met vitamien A nie tot 'n onbepaalde opgaring van dié vitamien lei nie. Daardeur is nou die vraag geopper deur watter meganisme die liggaam die hoeveelheid vitamien A wat geabsorbeer en opgegaar word, kan beheer. Die langtermynuitwerkings van 'n matige oorvloed aan vitamien A by bobbejane word noukeurig dopgehou.

#### **Eksperimentele Kanker**

Daar is ontledings gemaak van die chemiese bestanddele van die bloed en die gal in diere waar kanker van die lewer veroorsaak is deur die voer met 'n besondere kankerverwekkende stof. Die doel van die ondersoek was om 'n begrip te kry van die chemiese veranderings wat die ontwikkeling van lewerkanker—'n algemene siekte by die Bantoe—voorafgaan en vergesel.

Laboratoriumeksperimente het getoon dat tiroksien (die chemiese produk van die skildklier) die ontwikkeling van deur proewe oorgedrae kanker van die lewer by diere wat met mieliekos gevoer word, grootliks verhaas. Daar word gehoop dat vasgestel kan word of daar enige ooreenkomstige veranderings in die galsure van die Bantoe plaasvind wat baie gereedliker lewerkanker ontwikkel as blankes.

#### **Suikersiekte**

Eksperimentele ondersoekte in verband met suikersiekte by bobbejane is voortgesit. Uit die studie wat tot op hede voltooi is, het geblyk dat die ernstigheid van suikersiekte (wat by die bobbejaan veroorsaak is deur verwydering van die alveesklier) nie slegs van die gebrek aan insulien afhang nie maar ook van die werking van die ander buislose kliere, naamlik die harsingslymklier, die skildklier en die byniere. By hierdie proefnemings met bobbejane is verskillende buislose kliere chirurgies verwyder en die bloedbestanddele met inbegrip van die suiker en die vette is herhaaldelik bepaal.

Die feit dat eksperimentele suikersiekte by die bobbejaan gepaard gaan met 'n merkwaardige toename in die verskillende bloedvette met inbegrip van cholesterol, het

in die laboratorium. This radio-A can be estimated in minute quantities in the blood and tissues and, after administration, its movements can be followed in the blood tissues.

Preliminary investigations have disclosed that the vitamin A is carried by a very specific protein in the blood. Further studies are in progress to determine the factors controlling the movement of vitamin A in and out of the liver. In this connection, it should be mentioned that vitamin A has been used as an indicator of the influence of domestication on bodily processes of the baboon. It has been shown that, although an increase of vitamin A in the diet increases the vitamin A content of the baboon's liver, a fact previously established in other animals, continued feeding of vitamin A does not lead to an unlimited storage of the vitamin. This has raised the question as to the mechanism whereby the body can control the amount of vitamin A which is absorbed and stored. The long-term effects of moderate excesses of vitamin A in baboons are being closely followed.

#### **Experimental Cancer**

Analyses have been made of the chemical constituents of the blood and of the bile in animals in which cancer of the liver has been produced by feeding a specific cancer-producing agent. The object of this investigation was to obtain some understanding of the chemical changes which precede and accompany the development of cancer of the liver, a disease which is common in the Bantu.

From experiments conducted in the laboratory, it has been shown that thyroxin (the chemical product of the thyroid gland) greatly accelerates the development of experimentally-induced cancer of the liver in animals fed a maize diet. It is hoped to ascertain whether there are corresponding changes in the bile acids in the Bantu who tend to develop liver cancer more frequently than do Europeans.

#### **Diabetes**

The experimental investigation of diabetes has been pursued in the baboon. From studies completed to date, it has been shown that the severity of diabetes (produced in baboons by removal of the pancreas) depends not only on the lack of insulin but also upon the activity of the other endocrine glands, namely, the pituitary, thyroid and adrenal. These experiments in baboons have involved the surgical removal of various endocrine glands and repeated estimations of the constituents of the blood, including the sugar and fats.

The fact that experimental diabetes in the baboon is accompanied by a remarkable increase in the various blood fats, including cholesterol, has provided a most



baie waardevolle voorwaardes geskep vir 'n ontleding van die faktore in die liggaam en die dieet wat die opgaring van oortollige vet in die weefsels en die hoeveelheid vet in die bloed bepaal. Die aktuele belangrikheid van hierdie waarnemings vir 'n begrip van die verhouding tussen vet en hartkwale en van die ernstige komplikasies wat suikersiekte by die mens meebring, hoef skaars nog benadruk te word.

## NAVORSINGSEENHEID VIR PNEUMOKONIOSE

*Hoof van die Eenheid:* dr. A. J. ORENSTEIN

Hierdie Eenheid word gesamentlik deur die Departement van Mynwese en die Transvaalse en Vrystaatse Kamer van Mynwese gefinansier. Die uiteindelijke doel van die Eenheid kan soos volg uiteengesit word: „Om pneumokoniose en sy oorsaak uit elke oogpunt te bestudeer en sodoende tot die voorkoming van die siekte by te dra”. Ter voortsetting van hierdie taak word dit in vier verdeel: Patalogie; Fisiologie/Liggaamstipering; Stof en Ingenieurswerk; Statistiek. 'n Kliniek vir die ondersoek en behandeling van mynwerkers vir borskwale word ook deur die Eenheid bestuur.

### Patologie

Die taak van hierdie afdeling is om die veranderings in die hart-aseemhalingsorgane wat teweeggebring word as gevolg van die inaseming van stof wat in myne en sekere ander nywerhede ontstaan, te ondersoek. Hierdie ondersoek is daarop gemik om te bepaal hoe die gesondheid deur stof aangetas word, en om 'n middel te vind om 'n dergelike aantasting van die gesondheid te verhoed of die gevolge daarvan te versag.

Die afdeling voer ook al die roetine-ondersoeke uit wat deur die Mediese Pneumokoniosieburo aangevra word. Laasgenoemde is verantwoordelik vir voorindiensnemings- en periodieke ondersoeke benewens ondersoeke vir die bepaling van ongeskiktheid weens pneumokoniose en tering. Deur laasgenoemde funksie bekom die afdeling 'n aansienlike hoeveelheid studiemateriaal. In die loop van die jaar is bv. die hart en longe van ongeveer 2,300 persone bestudeer, sowat 3,500 ander monsters ondersoek en 186 volledige lykskouings uitgevoer.

Die studie van pneumokoniose—die wetenskaplike versamelnaam vir stofsiertes—vereis baie proefnemings met diere en die gebruik van 'n aantal tegnieke ontleen aan die patologie, chemie en fisika. Die personeel van die afdeling is dan ook op hierdie grondslag saamgestel.

Die Afdeling Chemie hou hom nie slegs besig met die studie van chemiese veranderings wat deur stof in die longe veroorsaak word nie, maar ook met die studie van die uitwerking van medisyne en chemikalieë op die veranderings wat deur pneumokoniose veroorsaak word

useful situation for analysing the factors in the body and in the diet, which determine the accumulation of the excess fat in the tissues and the amount of fat in the blood. The relevance of these observations for the understanding of the relationship of fat to heart disease and of the serious complications of diabetes in man need hardly be emphasized.

## PNEUMOCONIOSIS RESEARCH UNIT

*Head of the Unit:* DR. A. J. ORENSTEIN

This Unit is financed jointly by the Department of Mines and the Transvaal and Orange Free State Chamber of Mines. Its ultimate purpose may be stated thus: "To study pneumoconiosis and its causation from every aspect; leading to the prevention of the disease". In order to pursue this task it is constituted in four Divisions: Pathology; Physiology/Somatotyping; Dust and Engineering; Statistics. The Unit also operates a clinic for the investigation and treatment of miners' chest diseases.

### Pathology

The task of this Division is to investigate the changes caused in the cardio-respiratory organs by the inhalation of dust produced in mining and certain other industries. The objective of these investigations is to ascertain the mechanism by which dust damages health, and to find means of preventing or ameliorating the damage.

The Division also does all the routine investigations required by the Pneumoconiosis Medical Bureau, which is charged with the duties of carrying out pre-employment and periodical examinations, as well as examinations for assessment of disability due to pneumoconiosis and tuberculosis.

The latter function brings the Division a wealth of material for study. For example, in the course of the year the heart and lungs of some 2,300 persons were studied, some 3,500 other specimens examined, and 186 complete autopsies performed.

The study of the pneumoconioses, which is the scientific name for all dust diseases, necessitates much animal experimentation and requires the use of a number of techniques appertaining to pathology, chemistry and physics. The staff of the Division is constituted accordingly.

The Chemical Section of the Division is concerned not only with the studying of the chemical changes caused by the dust in the lungs, but also with studying the effect of drugs and chemicals on the changes caused by



teneinde minstens 'n versagtingsmiddel, so nie 'n voorbehoedmiddel nie, te probeer uitvind.

#### **Fisiologie/Liggaamstipering**

Verskillende grade van ongeskiktheid word deur pneumokoniose veroorsaak. Party persone spring ongeskiktheid heeltemal vry. Om ongeskiktheid as gevolg van longaantasting akkuraat te bepaal, moet van presiese maatstawwe gebruik gemaak word. Namate die gegewens uit die metings van 'n groot aantal persone verkry (nl. dié wat aan stof blootgestel word en dié wat nie blootgestel word nie) versamel word, sal dit miskien moontlik wees om met 'n mate van noukeurigheid die rol wat stof speel, te isoleer van dié van ander faktore wat longbeskadiging veroorsaak.

Die afdeling het derhalwe die pulmonale funksies van goudmynwerkers en van spoorwegwerkers van dieselfde ouderdomsgroepe wat nie aan stof blootgestel was nie, met behulp van sorgvuldige metings met geskikte apparate bestudeer. Die bevindings word binnekort gepubliseer.

Die afdeling het ook die verskillende bekende metodes vir die bepaling van die verswakking van die longfunksie bestudeer, teneinde 'n eenvoudige metode te probeer vind wat die Pneumokonioseburo by roetine-ondersoeke van 'n groot aantal persone sou kan gebruik. Dit het geblyk dat nie een van die bepalings betroubaar genoeg was vir 'n kritiese beoordeling nie maar dat 'n kombinasie van verskeie maatstawwe betroubare resultate lewer. Verdere ondersoeke sal nog uitgevoer word.

Onder liggamstipering verstaan ons die bestudering van die samestelling van die liggaam, soos bv. die verhouding van vet tot spiere en been, van lengte tot borsmaat en gewig. Jare se praktiese ondervinding het bewys dat sekere tipes individue meer vatbaar vir toring en silikose is as ander, maar daar bestaan geen redelike betroubare gegewens oor hierdie belangrike onderwerp nie. Die toepassing van bestaande norme is die oorsaak van talle afkeurings vir indiensneming—wat miskien wel of miskien nie nodig is nie. Dit spreek vanself dat dit belangrik is om meer inligtings in te win. Die Afdeling Liggaamstipering is in die lewe geroep om hierdie saak sistematies en in besonderhede te bestudeer. Moderne toerusting en tegnieke kan miskien die ontwikkeling van 'n metode moontlik maak wat vir roetinerwerk gebruik sou kan word. Die vereiste apparaat is reeds gebou en word tans getoets.

Die afdeling het waardevolle hulp verkry van die Kardio-Pulmonale Eenheid van die W.N.N.R. wat in die Johannesburgse Algemene Hospitaal gehuisves is.

#### **Stof en Ingenieurswerk**

Hierdie afdeling hou hom besig met 'n studie van stofontwikkeling en -beheer in myne. Sekere ondersoeke word in opdrag van Rand Mines Ltd., uitgevoer. 'n Spesiale kamer is in 'n myn gebou en toegerus met die vereiste apparaat vir die noukeurige bepaling van die

pneumoconiosis in an endeavour to discover, if not a preventive, at least an ameliorative drug.

#### **Physiology/Somatotyping**

Pneumoconioses cause varying degrees of disability in individuals. Some escape disability altogether. To assess pulmonary disability accurately it is necessary to make use of precise measurements. As data from the measurements of many persons (those exposed to dust and those who have not been so exposed), accumulate, it may be possible to separate with some accuracy the role played by dust from that of other factors causing lung damage.

The Division has therefore studied by careful measurements with appropriate apparatus, the pulmonary functions of gold miners, and of railway workers of similar age groups who have not been exposed to dust. The findings are about to be published.

The Division has also studied the various known methods of assessing impairment of lung function with the aim of finding a simple method which could be used by the Pneumoconiosis Bureau in the routine medical examination of a large number of persons. It was found that no one determination was sufficiently reliable for critical assessment, but that a combination of several gave reliable results. Further investigations will be carried out.

Somatotyping means the study of bodily make-up, such as the ratio of fat to muscle and bone, height to chest measurement and weight. Years of practical experience have shown that certain types of individual are more likely to succumb to tuberculosis and even silicosis than others, but there are no reasonably accurate data on this important subject. Use of the present standards causes large numbers of rejections for employment, which may or may not be necessary. It is obviously important that more information should be obtained. The Somatotyping Section is set up to study this matter systematically and in detail. Modern apparatus and techniques may make it possible to evolve a method which could be used in routine work. The required apparatus has been assembled and is being tested.

The Division has received valuable assistance from the Cardio-Pulmonary Unit of the C.S.I.R. housed at the Johannesburg General Hospital.

#### **Dust and Engineering**

This Division is concerned with the study of dust production and its control in mining operations. Certain investigations are carried out under contract with Rand Mines, Limited. A special chamber has been constructed in a mine and equipped with the required apparatus for



stof deur verskillende tipes boormasjiene veroorsaak wat op verskillende maniere werk. Hierdie span maak ook 'n studie van die stofgevaar waaraan mynwerkers by verskillende soorte werk dwarsdeur die dag blootgestel word. Die studie word tans op delwers toegespits. Namate addisionele personeel gewerf en vir hierdie veeleisende werk opgelei word, sal die ondersoek ook uitgebrei kan word. Deur hierdie studie word daar geprobeer om te bepaal hoe blootstelling aan die stof wat onvermydelik by 'n bepaalde soort werk gemaak word, tot 'n minimum beperk kan word.

Die Stoflaboratorium van die Kamer van Mynwese is besig met verkeie studies in verband met stofmeting veral met behulp van 'n elektronmikroskoop. 'n Uitgebreide studie word beplan in verband met stofontwikkeling onder die werklike bedryfstoeistande in 'n myn, en die verspreiding van die stof onder die invloed van allerlei lugbewegings, en dit word binnekort deur die Stoflaboratorium van die Kamer van Mynwese aangepak.

### Statistiek

Die massa verslae wat in die Mediese Pneumokoniose-buro opgehoop het, is nooit behoorlik ontleed nie. Die vernaamste taak van hierdie afdeling is om soveel moontlik inligting uit hierdie materiaal te verkry. Dit is 'n moeilike taak veral omdat baie van die verslae gedeeltelik onbetroubaar en ander onleesbaar is. Nogtans is gedurende die jaar ongeveer 10,000 rekords van mynwerkers wat skadeloosstelling weens silikose ontvang het oorgeskryf, en hulle is tans feitlik gereed om wiskundig ontleed te word.

Wat die statistiese sy van die werk betref, het hierdie afdeling ook die Stof- en Patologie-afdelings met die beplanning van hulle eksperimente gehelp.

### Pneumokoniosekliniek

'n Kliniek genoem „Die Borskliniek vir Mynwerkers” is in September 1957 in die lewe geroep. Huisvesting word deur die Provinsiale Administrasie op die terrein van die Johannesburgse Algemene Hospitaal verskaf. Die doel van die kliniek is om geriewe vir spesiale diagnoseering en behandeling van die gebreke te verskaf wat deur pneumokoniose en veral silikose veroorsaak word. Hopelik sal daardeur ook verbeterde genesingsmetodes uitgevind word. Die kliniek is met spesiale apparate sowel vir diagnose as behandeling toegerus, wat gewoonlik nie in private praktyke of selfs in hospitale beskikbaar is nie. Die weerklank wat die daarstelling van die kliniek by die silikoselyers gevind het, was bo verwagting en die min of meer geïmproviseerde akkommodasie word tot die uiterste benut.

### Internasionale Konferensie oor Pneumokoniose

Die regering het die W.N.N.R. versoek om 'n internasionale konferensie oor pneumokoniose saam te roep. Dit word in Februarie 1959 in Johannesburg gehou. Sestien wêreldberoemde deskundiges uit Duitsland, Frank-

accurate measurements of the dust produced by machine drills of various types and operated in a number of alternative ways. A study is also being made by this team of the dust hazard to which miners in various occupations are exposed throughout the day's work. At present the study is concentrated on stopers. It will be expanded as additional personnel are recruited and trained for this exacting work. The aim of this study is to determine how, in a given occupation, the least exposure could be achieved to such dust as is unavoidably produced.

The Chamber of Mines Dust Laboratory is engaged in several studies of the measurement of dust, particularly by means of electron microscopy. An elaborate study of the production of dust in actual working conditions in a mine and its dispersion under the influence of various air movements has been planned and will shortly be started by the Chamber's Dust Laboratory.

### Statistics

The mass of records accumulated in the Pneumococniosis Medical Bureau has never been adequately analysed. The principal task of this Division is to extract as much information as possible from this material. It is a difficult task, mainly because many of the records are not completely reliable and many are illegible. However, during the year some 10,000 records of miners compensated for silicosis have been transcribed and are now almost ready for mathematical analysis.

From the statistical standpoint this Division has also assisted the Pathology and Dust Divisions in planning their experiments.

### Pneumoconiosis Clinic

A clinic named “The Miners' Chest Clinic”, was established in September, 1957. Accommodation is provided by the Provincial Administration in the grounds of the Johannesburg General Hospital. The purpose of the clinic is to provide specialized diagnosis and treatment of the disabilities caused by pneumoconiosis, particularly silicosis. It is also hoped that improved remedial measures may be discovered. The clinic is equipped with special apparatus for both diagnosis and treatment, such as is not usually available in private or even hospital practice. The response from silicosis sufferers has been greater than was expected, and the more or less extemporised accommodation is strained to its utmost capacity.

### International Conference on Pneumoconiosis

The Government has requested the C.S.I.R. to convene an international conference on pneumoconiosis. This will be held in Johannesburg in February, 1959. Sixteen persons of international renown have been invited from



ryk, Groot-Brittanje, België, Switserland, die Verenigde State en Noord-Rhodesië is daarheen uitgenooi en het die uitnodigings aangeneem. Ander lande, sowel as die W.G.O. en die I.A.O., sal ongetwyfeld ook afgevaardigdes stuur, en Suid-Afrika sal natuurlik ook in belangrike mate aan die beraadslagings deelneem. Die hoofdoel van die konferensie is om 'n oorsig te gee van die kennis wat in die jongste tyd verwerf is, en om onderwerpe en metodes vir verdere navorsing aan te beveel.

## TERINGNAVORSINGSEENHEID

*Hoof van die Eenheid:* DR. B. A. DORMER

Hoewel daar sedert die nuwe teringbestrydingsmiddels bekend geword het, 'n afname in die aantal sterfgevälle aan tering was, was daar geen vermindering in die aantal teringgevälle wat voorgekom het nie. Dieselfde is in ander dele van die wêreld opgemerk. Die rede is dat daar baie mense, en veral nie-blankes, is wat, was dit nie vir die nuwe geneesmiddel, vandag nie nog in lewe sou gewees het nie. Hulle siekte het die stadium bereik waarin dit so chronies is dat hulle as invalides in die hospitale moet bly. Slegs 'n deel van die gevälle kan chirurgies behandel word. Nog 'n ontmoedigende aspek van die nie-blanke probleem is dat 'n hele aantal gevälle wat deur hospitaal-behandeling opgeklaar is, later in 'n baie verergerde toestand terugkeer en dan kan die geneesmiddels hulle nog minder na die aktiewe lewe terugvoer. Dit is dus duidelik hoe die behoefte aan meer beddens vir nie-blankes ontstaan, hoewel dit nie noodsaaklikerwys beteken dat die siekte self aan die toeneem is nie. Die indruk dat die voorkoms taamlik staties is, word bevestig deur die syfers van die Durbanse Industriële Opname deur dr. E. Fine en sy kollegas in die Durbanse Borslyers-kliniek gedoen.

Die eenheid is hard besig met werk in verband met teringbasille wat teen een van die vernaamste tering-geneesmiddels, isonikotienuurhidrasied, in die wandel bekend as isoniasied of INH, bestand is. Daar word oor die algemeen bevind dat namate die basille teen hierdie middel bestand raak, hulle tegelykertyd minder gou die siekte by 'n vatbare dier veroorsaak, en ons lei daaruit af dat hulle dan ook minder gou die siekte by die mens sal veroorsaak. By die mens is inderdaad teringbasille afgesonder wat so goed as geen siekte by 'n marmotjie veroorsaak nie. Bowendien het geblyk dat die marmotjie daarna teen besmetting deur virulente basille bestand was; met ander woorde, dit het beveilig geword. Dit vereis nie baie verbeeldingskrag om te besef hoe belangrik hierdie bevinding is nie en hoeveel meer werk daar nog gedoen sal moet word om hierdie hele kwessie van bestandheid teen geneesmiddelle in verband met behandeling van die siekte en die reperkussies daarvan op die openbare gesondheid op te helder nie.

Germany, France, Great Britain, Belgium, Switzerland, the United States and Northern Rhodesia, and have accepted the invitations. Delegates will doubtless be sent by a number of other countries and the W.H.O. and I.L.O., and South Africans will naturally take an important part in the deliberations. The principal purpose of the conference is to review recently acquired knowledge and to recommend the subjects and methods for further research.

## TUBERCULOSIS RESEARCH UNIT

*Head of the Unit:* DR. B. A. DORMER

Although there has been a drop in the mortality of the disease since the advent of the new anti-tuberculosis drugs there has been little corresponding drop in the morbidity. This has also been the finding in other parts of the world. The reason is that there are many people, especially non-Europeans, who, but for the new drugs, would not be alive today. Their disease has reached a stage of chronicity which keeps them as hospital invalids. Surgery helps a proportion of these cases. Another depressing aspect of the Non-European problem is that quite a number of cases that are cleared up by hospital treatment return at a later date with advanced disease. The drugs are now less able to put them back into active life. It can be seen, therefore, how the need arises for an increase in the number of Non-European beds, though this does not necessarily mean that the disease itself is on the increase. The impression that the incidence is somewhat static is supported by the figures of the Durban Industrial Survey made by Dr. E. Fine and his colleagues at the Durban Chest Clinic.

The unit is very much occupied with work on tubercle bacilli that are resistant to one of the chief anti-tuberculosis drugs, isonicotinic acid hydrazide, commonly called isoniazid or INH. It is a general finding that as the bacilli become resistant to this drug they become at the same time less disease-producing in a susceptible animal, and we assume from this that simultaneously they become less disease-producing in the human subject. Tubercle bacilli have in fact been isolated from a human case that produce practically no disease whatever in a guinea-pig. Moreover this guinea-pig was thereafter found to be resistant to infection from virulent bacilli; in other words it had become protected. It requires no stretch of imagination to realize how important this finding is, and what a lot of further work remains to be done to elucidate this whole subject of drug resistance in relation to the treatment of the disease, and the public health repercussions to it.

The Unit hopes, in the near future, to use monkeys for the purpose of testing these resistant organisms. It



Hopelik sal in die nabye toekoms van ape gebruik gemaak kan word om hierdie bestande organismes te toets. Daar word gereken dat deur hierdie soort dier te gebruik 'n duideliker vergelykbare beeld van die soort siekte verkry sal word wat so 'n organisme veroorsaak of sou veroorsaak wanneer 'n mens pas daarmee besmet is.

Nog iets waaraan aandag bestee word, is die bevinding dat sommige van hierdie bestande stamme vinniger en kragtiger groei as 'n sekere hoeveelheid isoniasied in die voedingsbodem opgeneem word. Uit hierdie bevinding sou mens kan aflei dat daar nou 'n middel bestaan om te bepaal wanneer die isoniasiedbehandeling deur 'n ander vervang moet word.

### Die Verswakte Organisme

Lae patogeniteit by die marmotjie kom gewoonlik voor by 'n bakteriebevolking wat 'n verhoogde INH-weerstand verwerf het, maar dit is nie altyd die geval nie aangesien daar een of twee stamme is wat biologies verswak en tog nog gevoelig vir die geneesmiddel is.

By die mens sal 'n organisme met verlaagde patogeniteit miskien nie altyd op 'n sagte of siektebeperkende manier werk nie, aangesien die natuurlike weerstand van die individu in aanmerking geneem moet word. Wanneer daar nie veel weerstand gebied word nie, sal die invalskrag van die verswakte basille miskien betreklik hoog lyk. Inderdaad kan nie by die behandeling van tuberkulose verwag word om met geneesmiddele alleen baie ver te kom nie as die menslike weerstand vanweë ondervoeding of 'n ander tussenkomende siektetoestand laag is nie en kan ook om dieselfde rede geen voorspelling gedoen word van watter tipe siekte 'n sogenaamde verswakte organisme sal veroorsaak nie.

### Atipiese Basille

Organismes van hierdie tipe is taamlik dikwels aangef, somtyds tegelyk met 'n gewone infeksie en somtyds as die enigste infekterende organisme. Hulle word gewoonlik ontdek deur hul eienaardige kleurreaksies op 'n voedingsbodem. Die rol wat hulle speel wanneer hulle gelyk met T.B.-besmetting voorkom, het ons nog nie kon vasstel nie. Werkers in ander dele van die wêreld skyn die bewys te gelewer het dat hulle self 'n soort long-siekte kan veroorsaak.

Lede van die eenheid het 'n aantal (20) blanke en nie-blanke chroniese gevalle geneem en baie deeglik op die kwessie van bakterievariasie ingegaan. Vir al hierdie gevalle is 'n spesiale navorsingslêer aangelê waarin soveel moontlik gegewens versamel is, dog afgesien van die bakteriologiese aspek was die vernaamste sekondêre aandag op die toegepaste behandeling gerig. Hierdie werk het 'n paar baie interessante feite aan die lig gebring. Die bedoeling is om dit op nog 'n reeks te herhaal, maar hierdie keer sal gevalle gekies word wat baie basille afskei. Die rede waarom hierdie soort geval gekies word, is gebaseer op 'n bevinding in die huidige

is felt that by using this animal a clearer comparable picture will be obtained of the type of disease such an organism produces or would produce as a fresh infection in the human subject.

Another matter engaging attention is the finding that some of these resistant strains grow more rapidly and vigorously if a certain amount of isoniazid is incorporated in the culture medium. This finding suggests that there is now a means of determining when a change of treatment from isoniazid should be made.

### The Attenuated Organism

A low pathogenicity for the guinea-pig is usually found in a bacterial population that has acquired an elevated INH resistance, but this is not invariably the case as there are one or two strains that are biologically attenuated and yet are still sensitive to the drug.

In the human subject an organism of lowered pathogenicity may not always act in a mild or disease-limiting manner, since the natural resistance of the individual has to be taken into consideration. Where the defences are down the invasive power of the attenuated bacilli may appear to be relatively raised. In effect, one cannot in dealing with tuberculosis expect to get very far with drugs alone if the human resistance is lowered by malnutrition or other inter-current disease, nor for this reason can a forecast be made of what type of disease a so-called attenuated organism will produce.

### Atypical Bacilli

Organisms of this type have been found quite frequently, sometimes in association with an ordinary infection, and sometimes as the only infecting organism. They are found as a rule through their peculiar colour reactions on culture. What part they play in association with a T.B. infection it has not yet been possible to ascertain. Workers in other parts of the world appear to have shown that they can produce a type of lung disease by themselves.

Members of the unit have taken a number (20) of both European and Non-European chronic cases and gone into the matter of bacterial variation very thoroughly. All these cases have a special research file in which as much information as possible has been collected, but apart from the bacteriology the main secondary focus has been on the treatment given. Some of these cases have since died. Some very interesting facts have been disclosed by this work. It is intended to repeat it on a further series, this time choosing cases that are excreting very numerous bacilli. The reason for choosing this type



reeks. 'n Verslag oor hierdie werk sal aan die Komitee voorgelê word.

'n Baie interessante proefneming word op 'n Natalse melkkudde gedoen in samewerking met die Departement van Landbou (Onderstepoort). Die proefneming het as doel om te bepaal of jong kalwers en verse teen beestering beskerm sou kan word deur hulle elke dag 'n klein profylaktiese dosis isoniasied in hul voer te gee. Daar skyn min twyfel te bestaan dat ten spyte van baie besmetting by die ouer koeie, die jong beeste onaangetas bly. Hierdie metode van voorbehoeding word nou ook toegepas op ander kuddes in die land.

## VIRUSNAVORSINGSEENHEID

*Waarnemende Hoof van die Eenheid:* PROF. A. KIPPS

Netsoos in die verlede het die Eenheid hom hoofsaaklik besig gehou met fundamentele navorsing i.v.m. die fisiese eienskappe en die gedrag van 'n aantal verskillende virusse en die oplosbare antigene wat dikwels gelyk met hulle in virusbesmette weefsels voorkom. Sekere aspekte van die werk is in samewerking met ander viruslaboratoriums in die Unie van Suid-Afrika nagevors. Die patogenese van Coxsackie- en herpesvirussiektes en die epidemiologie van plaaslike uitbrekings van influensa-, Coxsackie- en poliomiëlitis-infeksies is ook bestudeer.

### Elektroforese van Virusse

Dit het geblyk dat sone-elektroforese in 'n digtheidsgradiënt vir virusstudies geskik is. Hierdie nuwe tegniek kan sowel vir suiwering gebruik word as vir vergelyking van die beweeglikheid van verskillende virusse en verskillende stamme van dieselfde virus.

As suiweringsmetodes het sone-elektroforese die voordeel dat dit uitstekende resultate oplewer en dit is veral nuttig in die geval van virusse wat so gevoelig vir chloroform is dat hierdie stof nie gebruik kan word om proteïensuiwerhede te verwyder nie. Fraksies deur elektroforese verkry, is verder deur ultrasentrifugering gesuiwer en slenkalkoorsvirus wat so behandel is, was geskik vir elektronmikroskopie. Hopelik sal die metode tot die opsporing en afsondering van variantstamme uitgebrei kan word. Voorlopige pogings om gemengde virusse te skei het veelbelowende resultate opgelewer.

### Agarjelpresipitentegnieke

Nuwe apparaat is ontwerp wat dit moontlik maak om 'n kwantitatiewe studie te maak van die presipitienerskytsel in jelle. Die wiskundige teorie van die verskytsel is uitgewerk en dit is tans moontlik om d.m.v. hierdie metode antigeenkonsentrasies en diffusiekonstantes te bepaal.

of case is based on a finding in the present series. A report on this work will be presented to the Committee.

A most interesting experiment is being undertaken on a Natal dairy herd in conjunction with the Department of Agriculture (Onderstepoort). The aim of the experiment is to see if the young calves and heifers could be protected from bovine tuberculosis by giving them a small prophylactic dose of isoniazid daily in their food. There seems to be little doubt that in spite of much infection in the older cows the young stock are remaining free of disease. This method of prophylaxis is now being extended to other herds in the country.

## VIRUS RESEARCH UNIT

*Acting Head of the Unit:* PROF. A. KIPPS

As in previous years the Unit was chiefly concerned with fundamental research into the physical properties and behaviour of a variety of viruses and the soluble antigens with which they are frequently associated in virus-infected tissues. Certain aspects of the work were carried out in collaboration with other virus laboratories in the Union of South Africa. The pathogenesis of Coxsackie and herpes virus diseases and the epidemiology of local outbreaks of influenza, Coxsackie and poliomyelitis infections were also studied.

### Electrophoresis of Viruses.

It was found that zone electrophoresis in a density gradient is well suited to virus studies. This new technique may be used both for purification and for comparison of the mobilities of different viruses and different strains of the same virus.

As a method of purification zone electrophoresis has the advantage of giving excellent yields and is particularly useful in the case of viruses so sensitive to chloroform that this substance cannot be used for removing protein impurities. Fractions obtained by electrophoresis were further purified by ultracentrifugation, and Rift Valley Fever virus so treated was suitable for electron microscopy. It is hoped to extend the method to the detection and isolation of variant strains. Preliminary attempts to separate mixed viruses have given promising results.

### Agar Gel Precipitin Techniques

New apparatus was designed enabling quantitative studies to be made on precipitin phenomena in gels. The mathematical theory of the phenomenon has been elaborated and it is now possible to estimate antigen concentrations and diffusion constants by this method.



### **Bepaling van Deeltjiegroottes**

Die deeltjiegroottes van die Cocksackie-groep virusse en die virusse wat in gevalle van knoppiesvelsiekte by beeste afgesonder is, word gemeet.

### **Afsondering en Suiwering van Oplosbare Antigene**

Vordering is gemaak by die pogings om suiwere oplosbare hondsdelheidsantigene uit die brein van besmette muise te berei, en 'n minieme hoeveelheid oplosbare antigeen wat by sone-elektroforese homogeen geblyk te wees het, is deur 'n proses verkry wat uit 5 stadia bestaan het. Aangesien die oprings in elke stadium slegs sowat 30 persent is, gaan die versameling van voldoende materiaal vir ontleding, maar stadig.

Aangesien die bestaande metodes vir roetinemikroanalise van biologiese materiaal ryk aan proteïen en nukleïensuur onbevredigend is, is addisionele besonderhede omtrent die vordering van die suiwering deur sone-elektroforese, agarjelpresipitering en immuno-elektroforese in agar verkry. 'n Nuwe metode is ontwerp vir die verwydering van antigene onsuiverhede waarby die gedeeltelik gesuiwerde antigeen deur 'n konsentrasie-gradiënt van geskikte antistowwe gestuur word.

### **Ander Studies i.v.m. Oplosbare Antigene**

Verdere werk is gedoen i.v.m. die oplosbare antigeen van die MEF<sub>1</sub>-stam van die poliovirus. Nadat komplementfikseringstoetse aan die lig gebring het dat hierdie virus groot hoeveelhede oplosbare antigeen in die brein van soogmuise produseer, is getrag om oplosbare antigeen in kulture van aapnieweefsel vas te stel.

Die aanpassing van tipe I (Mahoney) poliovirus en tipe III (Leon) poliovirus vir die brein van soogmuise was buitengewoon moeilik. In eersgenoemde geval is 'n mate van sukses behaal deur alternatiewe weefselkultuur/muisbreinoorinspuiting. Hierdie verlengde prosedures is 'n noodsaaklike stap in die verdere bestudering en vergelyking van die oplosbare antigene.

### **Studies i.v.m. Diervirusse**

Eenfasige groeiurweproofnemings met die Cyprusstam van die bloutongvirus is nog nie voltooi nie dog daar is reeds vasgestel dat die eerste groeisyklus binne die eerste 8 tot 12 uur in 'n kultuur van skaapnieweefsel plaasvind.

Twee nuwe virusse wat in die Onderstepoortlaboratoriums in gevalle van knoppiesvelsiekte by beeste afgesonder is, is bestudeer d.m.v. weefselkultuurtegnieke om hul groeiëdrag in kulture van kalf- en skaapselle te ondersoek. Die fisiese eienskappe van die viruspreparate wat as gevolg van hierdie werk beskikbaar geword het, word ook bestudeer.

### **Nie-spesifieke Stremstof in Verskillende Dierlike**

#### **Sera vir CT/W-virus**

Vroeëre ondersoek het aan die lig gebring dat die stremstof in verskillende dierlike sera aanwesig is, dog

### **Particle Size Determinations**

The particle sizes of the Cocksackie group of viruses and the viruses isolated from cases of lumpy skin disease in cattle are being measured.

### **Isolation and Purification of Soluble Antigens**

Attempts to prepare pure rabies soluble antigen from the brains of infected mice have advanced and a minute amount of soluble antigen which appeared to be homogeneous on zone electrophoresis was obtained by a five stage process. As the yields at each stage are only about 30 per cent, accumulation of enough material for analysis is slow.

Since existing methods for routine microanalysis of biological materials rich in protein and nucleic acid are unsatisfactory, additional information about the progress of purification was obtained by zone electrophoresis, agar gel precipitation and immuno-electrophoresis in agar. A new method for removing antigenic impurities by passing the partially purified antigen through a concentration gradient of appropriate antibodies has been devised.

### **Other Studies on Soluble Antigen**

Further work was done on the soluble antigen of the MEF<sub>1</sub> strain of poliomyelitis virus. After it was found by complement fixation tests that this virus produced large amounts of soluble antigen in suckling mouse brains, attempts were made to demonstrate soluble antigen in monkey kidney tissue cultures.

The adaptation of type I (Mahoney) poliovirus and type III (Leon) poliovirus to suckling mouse brains proved to be extremely difficult. With the former some success has been achieved by alternate to-and-fro mouse tissue culture passage. These extended procedures are a necessary step to the further study and comparison of the soluble antigens.

### **Studies on Animal Viruses**

One-step growth curve experiments with the Cyprus strain of bluetongue virus have not yet been completed but it is established that the first growth cycle takes place within the first 8-12 hours in sheep kidney tissue culture.

Two new viruses, isolated from the Onderstepoort Laboratories from cases of lumpy skin disease in cattle were studied by tissue culture techniques to investigate their growth behaviour in cultures of calf and sheep cells. The physical properties of the virus preparations available as a result of this work are also being studied.

### **Nonspecific Inhibitor in Various Animal Sera to CT/W Virus**

Previous studies revealed that the inhibitor was present in a variety of animal sera but absent from fowl serum.



nie in hoenderserum nie. 'n Paar van sy fisiese en chemiese kenmerke is bepaal.

Die stremstof word tans nog verder gesuiwer en met die Francis- en Chu-stremstowwe vergelyk. 'n Titreermetode in enkellae van kuikenembriose is uitgewerk, waardeur die stremstowwe noukeurig bepaal en vergelyk kan word.

#### **Plaaslike Epidemies van Virussiektes**

Gedurende die verslagjaar het daar in Kaapstad 'n baie ernstige polio-epidemie voorgekom wat van April 1956 tot Junie 1957 geduur het; in Julie en Augustus 1957 is die stad deur Oosterse griep geteister en in April en Junie 1957 was daar twee uitbrekings van miokarditis by pas-gebore kinders deur die Cocksackievirus veroorsaak.

Die Virusnavorsingseenheid het by die diagnosering van poliogevalle gehelp, en veral in gevalle wat „aseptiese meningitis” genoem word.

Toe die influensa-epidemie in die Kaap geheers het, is die virus wat dit veroorsaak, uit twee groepe gevalle in die Stellenbosch- en die Langa-lokasie afgesonder en geïdentifiseer as die virus van die Oosterse griep. Gedroogde monsters van hierdie isolate is onmiddellik na die Wêreldinfluensasentrum in Londen gestuur. 'n Klein hoeveelheid griepentstof (1,200 dosisse) is van hierdie virus berei en aan die provinsiale en munisipale owerhede gestuur vir beskerming van hul sleutelpersoneel.

Die miokarditisuitbrekings deur die Cocksackie-virus veroorsaak, het onder die pasgebore kinders in 'n private kraaminrigting voorgekom. Hierdie epidemies is volledig ondersoek uit die epidemiologiese en die virologiese oogpunt.

#### **GEVANGENISNAVORSINGSGROEP I.V.M. DIEET EN METABOLISME EN HUL VERBAND MET HART-BLOETVATSIEKTES**

*Leier van die Groep: DR. P. J. KLOPPERS*

Die Gevangenisdiëtprojek beoog in die eerste plek om lig te werp op die rol wat dieetfaktore by die veroorsaking van aterosklerose speel. Aangesien kroonslagaarverharding baie meer by die blanke deel van die bevolking van ons land voorkom as by die Bantoedeel, bied hierdie projek 'n unieke geleentheid om die redes vir hierdie verskil na te gaan en om te bepaal of die hipotese, wat tans algemeen aanvaar word, dat 'n hoë inname van sekere vetsoorte een van die hoofoorsake is wat atero-genese bevorder, steek hou.

Die voordele van hierdie vergelykende studie is dat twee rasse-groepe, wat 'n groot verskil vertoon in hul neiging tot die ontwikkeling van kroonslagaarverharding en hartspierverstopping, gelyktydig lang tydperke onder beheerde toestande wat van tyd tot tyd volgens plan gewysig kan word, bestudeer word. Sodoende word dit moontlik om variasies in die metaboliese sfeer waar-

Some of its physical and chemical characteristics were established.

The inhibitor is now being further purified and compared with the Francis and Chu inhibitors. A method of titration in monolayers of chick embryo cells has been devised which enables the inhibitors to be accurately determined and compared.

#### **Local Epidemics of Virus Diseases**

Cape Town experienced a most severe epidemic of poliomyelitis extending from April, 1956, to June, 1957, a wave of Far East influenza in July and August, 1957, and two outbreaks of Cocksackie virus myocarditis of the newborn in April and June, 1957.

The Virus Research Unit assisted in the diagnosis of poliomyelitis cases with particular reference to those cases referred to as “aseptic meningitis”.

When the influenza epidemic passed through the Cape the causal virus was isolated from two groups of cases at the Stellenbosch and Langa locations and identified as the Far East strain of influenza virus. Dried samples of these isolates were despatched immediately to the World Influenza Centre in London. A small batch of influenza vaccine (1,200 doses) was prepared from this virus and sent to the Provincial and Municipal authorities for protection of their key personnel.

The outbreaks of Cocksackie virus myocarditis of the newborn occurred in a privately owned maternity nursing home. These epidemics were fully investigated from the epidemiological and virological viewpoints.

#### **PRISON RESEARCH GROUP ON DIET AND METABOLISM RELATING TO CARDIO-VASCULAR DISEASE**

*Leader of the Group: DR. P. J. KLOPPERS*

The Prison Diet Project is an undertaking designed primarily to throw light on the role of dietary factors in the causation of atherosclerosis. The incidence of coronary atherosclerosis in the European section of the population of this country being considerably higher than that observed in the Bantu, this project affords an unique opportunity for enquiring into the reasons for this difference as well as for testing the validity of the currently-held hypothesis that a high intake of certain classes of fat is a prime factor in promoting atherogenesis.

The advantages of this comparative study are that two racial groups, differing widely in their proclivity towards the development of coronary atherosclerosis and myocardial infarction, are being studied simultaneously for prolonged periods under controlled conditions, which latter can be varied from time to time according to plan. Thus, it is possible to correlate variations observed in



geneem, te korreleer met kliniese veranderinge wat miskien opgemerk word, veral dié in verband met die hart-bloedvatstelsel. Van besonder groot belang is die feit dat die projek geleentheid bied om die metaboliese en kliniese uitwerking wanneer Bantoeproefpersone oor 'n lang termyn op 'n blanke dieet gestel word, waar te neem, wat waardevolle bewyse behoort te lewer ter stawing of ter weerlegging van die bewering dat aterosklerose sy oorsprong in dieet het en ook belangrike besonderhede aan die lig behoort te bring van die metaboliese en biochemiese werkings waarmee dit in verband staan. Aangesien hierdie uitwerking wanneer dit plaasvind waarskynlik stadig en geleidelik sal ontwikkel, is dit absoluut noodsaaklik dat die waarnemings oor lang tydperke gedoen word. Wanneer die ondersoek te vroeg gestaak of sy bestek beperk word, sou dit die onderneming belangrik kan benadeel en dit is dus glad nie raadsaam nie.

Die projek as geheel is goed uitgedink, die toesig op die werk is op 'n hoë peil en die samewerking tussen die verskillende afdelings word goed gehandhaaf.

the metabolic sphere with any clinical changes which may be detected, particularly those pertaining to the cardio-vascular system. Of particular importance is the fact that the project affords the opportunity of observing the long-term metabolic and clinical effects of maintaining Bantu subjects on a European type of diet thereby providing valuable evidence for or against the dietary origin of atherosclerosis as well as important information concerning the metabolic and biochemical mechanisms involved. As these effects, should they occur, are likely to be slow and gradual in developing, it is essential that the observations be continued for prolonged periods. Premature termination of the investigation or a restriction of its scope will surely compromise the undertaking significantly and would be most inadvisable.

The project as a whole is well conceived, the supervision of the work is of a high order and the co-operation between the different sections is being well maintained.

## Nywerheidsnavorsings- institute

Om voorsiening te maak vir navorsing in Suid-Afrika se sekondêre nywerhede het die W.N.N.R. getrag om die verskillende nywerheidsgroepe aan te moedig om 'n aansienlike mate van verantwoordelikheid te aanvaar by die instelling van institute wat as maatskappye sonder winsbejag geïnkorporeer is en deur Beheerrade waarin die W.N.N.R. verteenwoordig is, bestuur word. Hierdie institute is vir hul fondse afhanklik van 5-jaarlikse garansies deur die nyweraarledede en op hierdie basis betaal W.N.N.R. £-vir-£-toekennings.

Die werksaamhede van hierdie Nywerheidsnavorsingsinstitute word hieronder korteliks opgesom. 'n Uitvoeriger verslag oor hulle werk verskyn in die Jaarverslag wat hierdie Institute afsonderlik uitgee.

### VISNYWERHEIDNAVORSINGSINSTITUUT

*Direkteur: DR. G. M. DREOSTI*

In April 1957 het die Instituut uit sy gehuurde perseel na sy ruim nuwe laboratorium op die terrein van die Universiteit van Kaapstad verhuis. Hierdie laboratorium wat gebou is met fondse deur die Suid-Afrikaanse Vismaaknywerheid geskenk, waartoe die W.N.N.R. £ vir £ bygedra het, is vir die gespesialiseerde behoeftes in verband met navorsing in die tegnologie van visserye ontwerp en toegerus en na nege maande se gebruik, het dit die bewys gelewer dat dit uiters geskik vir sy doel is. Die sorgvuldige beplanning van die laboratorium en sy ligging in die aangename akademiese omgewing van die Universiteit van Kaapstad betaal reeds diwidende in die vermeerderde produktiwiteit van die navorsingsresultate.

#### Ondersoeke

Gedurende die verslagjaar is voortgegaan met die verduursaming en hantering van vars vis in ys. Onder andere is die invloed van die grootte van die ysdeeltjies op die bewaringsduur, die was van gebruikte ys met water uit die hawe en die skoonmaak van aluminiumvisblikkies bestudeer.

'n Begin is gemaak met die bakteriologiese ondersoek van die velflora van vars stokvis. Die toename in die aantal organismes per vk. cm. is in verskillende toestande gedurende 'n reeks bewaringsproewe gemeet. Statisties was daar 'n duidelike verband tussen die aantal bakterieë op die vel en die numeriese beoordeling (bepaal deur 'n groep van drie tot vier opgeleide lede) van die varsheid van die vis volgens reuk.

Met die uitbreidende mark vir bevrore vis, is verskillende metodes vir groter meganisasie by hantering

## Industrial Research Institutes

In order to provide for research in South African secondary industry, the C.S.I.R. has endeavoured to stimulate the various industrial groups to accept a considerable measure of responsibility in setting up institutes incorporated as non-profitmaking companies managed by Boards of Control on which the C.S.I.R. is represented. These institutes are financed by five-yearly guarantees from the industrial subscribers, on the basis of which C.S.I.R. pays £ for £ grants.

The brief summaries included in the report that follows are of the activities of these Industrial Research Institutes. More detailed descriptions of their work can be found in the Annual Reports published separately by these Institutes.

### FISHING INDUSTRY RESEARCH UNSTITUTE

*Director: DR. G. M. DREOSTI*

In April, 1957, the Institute moved from its leased premises to its spacious new laboratory on the campus of the University of Cape Town. This laboratory, built with funds donated by the South African Fishing Industry and matched on a £ for £ basis by the C.S.I.R., was designed and fitted for the specialized needs of research in fisheries technology, and after nine months occupation, has proved to be very well suited to its purpose. The careful planning of the laboratory and its situation in the pleasant academic atmosphere of the University of Cape Town are already paying dividends in increased productivity of research results.

#### Investigations

Work on the preservation and handling of fresh fish in ice was continued. Various aspects studied included the influence of ice particle size on the length of the storage life, the washing of used ice with harbour water and the cleaning of aluminium fish containers.

Bacteriological studies of the skin flora of fresh hake were commenced. The increase in the number of organisms per sq. cm. was measured under varying conditions during a series of storage experiments. There was statistically a very high degree of correlation between numbers of bacteria occurring on the skin and the numerical odour evaluation (determined by a panel of three to four trained members) of the state of freshness of the fish.

With the widening market for frozen fish, various methods for increased mechanization in handling were



ondersoek. Aandag is veral geskenk aan die voordele van sproeipekeling bo dompelpekeling van mootjies, die kwessie van vassit aan die vorms gedurende bevriesing en die gebruik van spesiale sjeleisoorte om ontwatering en ontkleuring gedurende vriesbewaring te verminder. 'n Reeks bederftoetse is uitgevoer om te bepaal watter bevrore produkte saam met bevrore vis, en veral met bevrore gerookte vis, verskeep sou kan word.

Heelwat aandag is aan die pekeling en kleuring van mootjies wat gerook moet word en aan die eintlike rookmetodes geskenk. Die pekel waarin mootjies gesout word voor hulle gerook word, word slegs een maal gebruik en dan weggegooi, waardeur aansienlike hoeveelhede sout verlore gaan. Derhalwe is ondersoek of die pekel nie weer gebruik kan word nie; hierby is spesiale aandag bestee aan die bakteriologiese aspek en die aspek van openbare gesondheid en aan die goedhou-eienskappe van die finale produk. Uit hierdie toetse het geblyk dat pekel minstens twee keer, en waarskynlik meer male, gebruik kan word sonder nadelige gevolge vir die gesondheid of die kwaliteit van die produk.

In 'n verdere reeks toetse is optimum kleuringstoestand vasgestel. Daaruit het geblyk dat roer, die pH-konsentrasie, die temperatuur van die kleuroplossing, die onderdompelingsduur, en die verhouding van kleurvloeistof tot vis almal faktore is wat 'n rol speel by die verkryging van egalige kleuring en 'n aantreklike kleur.

Wat rookmetodes betref, is bewys dat die rook van stokvis in beheerde toestande nie alleen prakties moontlik is nie, maar dat daarmee in 'n baie korter tyd mootjies met 'n sterker rookgeur verkry kan word, as met natuurlike roking in 'n trek. 'n Ewe goeie tekstuur en velvorming, kleiner gewigsverliese, beter goedhou-eienskappe en meer egalige produkte is ook met beheerde roking verkry. Derhalwe gaan die nywerheid en die Instituut nog verder die toepassing van hierdie laboratoriumbevindings in die handel na.

Verdere ondersoek van verskillende tipes spanname om 'n groter mate van meganisering gedurende die bereiding en roking van mootjies moontlik te maak, is aan die gang.

Nuwe tipes kartonhouers wat in gebruik geneem is vir die verpakking van bevrore kreefsterte is gedurende die jaar ondersoek. Daarby het geblyk dat kartonhouers van 20 pd. en 10 pd. verskeie voordele bo houtkissies het omdat hulle ligter is om te hanteer en effens vinniger afgekoel kan word met minder verlies aan gewig.

'n Uitgebreide reeks toetse is in Walvisbaai aangepak as deel van 'n grondige ondersoek na die faktore wat die voorafkook van sardyne beïnvloed. Gedurende die voorafkook en daaropvolgende suiwering in 'n retort word 'n sekere hoeveelheid vloeistof uit die vleis van die vis vrygestel. Die inmaakfabriek streef daarna om soveel moontlik van hierdie vloeistof gedurende die voorkoking en dreinering te verwyder ten einde verdunning en verkleuring van die pekel of sous waarin die vis uiteindelik verpak word vir retortbehandeling te voorkom.

studied. In particular, attention was given to the advantages of spray-brining over immersion-brining of fillets, the question of sticking to moulds during freezing, and the use of special jellies to reduce dehydration and discoloration during frozen storage. A series of taint tests was carried out with the object of determining what frozen products might be shipped together with frozen fish, especially with frozen smoked fish.

Considerable attention was given to the brining and dyeing of fillets for smoking and to actual smoking procedures. The brine, in which fillets are salted before smoking, is used only once and then discarded, involving the loss of substantial quantities of salt. Accordingly, the re-use of brine was investigated with special attention to bacteriological and public health aspects and to the keeping qualities of the final product. It appeared from these tests that brine can be used at least twice and probably more often, without detriment to health or to the quality of the product.

In a further series of tests, optimum dyeing conditions were established. It was shown that agitation, the concentration pH, temperature of the dye solution, length of immersion period, and the ratio of dye solution to fish are all factors in securing uniform dyeing and an attractive colour.

With regard to smoking procedures, it was shown that smoking of hake under controlled conditions was not only feasible, but was capable of producing fillets with a stronger smoked flavour in a far shorter time than is possible with natural draft smoking. Equally good texture and pellicle formation, smaller weight losses, keeping qualities and more uniform products were also obtained with controlled smoking. Accordingly, the industry and the Institute are exploring further the commercial application of these laboratory findings.

Further investigations of different types of tenters to permit increased mechanization during the preparation and smoking of fillets are under way.

New types of cardboard containers, introduced for the packing of frozen rock lobster tails, were investigated during the year. It was found that 20 lb. and 10 lb. cardboard cartons had several advantages over wooden cases, being lighter to handle and permitting slightly faster cooling with less loss of weight.

An extensive series of tests was undertaken at Walvis Bay as part of a fundamental investigation into factors influencing the precooking of pilchards. During the pre-cook and subsequent retorting a certain amount of liquid is set free from the flesh of the fish. It is the aim of the cannery to remove as much as possible of this liquid during precooking and draining in order to avoid dilution and discoloration of the brine or sauce in which the fish is finally packed for retorting.

Initial results, issued as a Progress Report in November, indicated that a single pre-cook of 35 minutes duration,



Voorlopige resultate wat in November by wyse van 'n vorderingsverslag bekend gemaak is, het aangetoon dat 'n enkele voorkoking van 35 minute, gevolg deur 'n dubbele slotdreiner, die beste resultate opgelewer het. Dit het geblyk dat die vloeistof wat in die twee helftes van die vis versamel as dit met die stert boontoe gepak is, die hoeveelheid vloeistof gedurende dreiner verwyder, sterk beïnvloed en dat dit belangriker is om voorsorg te tref om daarvan ontslae te raak (bv. 'n dubbele slotdreiner) as om die dreineertyd te verleng of die bevredigende metodes vir voorkoking andersins te wysig. Verdere ondersoek het aan die lig gebring dat 'n voorkoker met die inlaat-ent heeltemal toe doeltreffender was as dié waarvan die inlaat-ent oor sy hele breedte oop was. Ook is aangetoon hoe belangrik dit is om die koker-voerband skoon te hou.

Die laboratorium in Walvisbaai het verder die gebruik van 'n blik wat effens korter (301×407) as die standaard-blik Al Tall (301×411) is, vir die verpakking van sardyne ondersoek. Die resultate het aangetoon dat die gebruik van die korter blik die voorkoms van die verpakte vis onveranderd sou laat dog die hoeveelheid vis en tamatie-puree om sardyne in tamatiesous te produseer, sou verminder. Ingeval die korter blik egter gebruik sou word, sou die fabriek moet sorg dat die verklaarde gewig 15 ons. is in plaas van 16 ons. wat dit tans is, aangesien die persentasie te ligte blikke anders buitensporig sou wees. Hierdie resultaat bevestig vroeëre navorsing by die Instituut.

Werk in verband met vismeel het heelwat van die laboratorium se tyd in beslag geneem. Die fundamentele uitwerking van die verskillende verwerkingstadiums en die verband met die gehalte van die grondstof is onbekend. Die Instituut het derhalwe begin met navorsing in verband met die uitwerking van verskillende kook- en persmetodes op die opbrings en kwaliteit van die resulterende vismeel en olie. Voorlopige waarnemings skyn daarop te dui dat sekere koker-perskombinasies geneig is om 'n beter resultaat op te lewer (perskoek met 'n laer olie- en voggehalte) as ander maar die redes hiervoor moet nog vasgestel word. Dit is reeds duidelik dat daar geweldige verskille bestaan in die vet- en oliegehalte van perskoeke wat onder taamlik gelykmatige handelstoestande geproduseer is, en dat die maksimum uitpersing van vog nie noodsaaklik met die maksimum uitpersing van olie saamhang nie. Verskille in die kwaliteit en samestelling van perskoeke kan nie sommer eenvoudig verklaar word volgens verskille in die kook- en persmetodes of volgens temperatuur-verskille nie.

Daar word beweer dat die kwaliteit van vismeel, veral wat die voedingswaarde betref, meer van goeie droging afhang as van behoorlike koking en persing. Gedurende die jaar het die Instituut begin om die toestande in vismeeldroërs te ondersoek in 'n poging om 'n beter insig in hierdie probleem te kry, en verskeie interessante waarnemings is gedoen. Die tempo waarteen vog in 'n direkte roterende droër van 60 vt. verwyder word, was die hoogste

followed by a double end-drain, gave the best results. It appeared that the liquid caught in the belly flaps of fish packed tail upwards substantially influenced the amount of liquid removed during draining and that it was more important to adopt precautions to get rid of it (e.g. a double end-drain) than to prolong the draining period or otherwise alter satisfactory precooking procedures. Further investigations indicated that a precooker with the inlet end totally enclosed was more efficacious than one in which the inlet end was open over its entire width. The importance of keeping the cooker conveyor belt clean was also demonstrated.

The Walvis Bay laboratory also investigated the use of a slightly shorter can (301×407) than the standard Al Tall (301×411) for packing pilchards. The results indicated that the use of the shorter can would leave the appearance of the pack unchanged, but would reduce the amount of fish and tomato puree required to produce pilchards in tomato. If the shorter can were to be used, however, factories should pack to a declared weight of 15 oz., instead of 16 oz., as at present, as the percentage of underweight cans would otherwise be excessive. This result confirms earlier work at the Institute.

Work on fish meal occupied a good deal of the laboratory's time. The fundamental effects of the various stages of processing, and their relation to the quality of the raw material, are unknown. Consequently, the Institute has begun an investigation into the effect of different methods of cooking and pressing on the yield and quality of the resultant fish meal and oil. Preliminary observations suggest that certain cooker-press combinations tend to give a better result (presscake of lower oil and moisture content) than others, but the reasons for this still have to be determined. It is already plain that tremendous variation exists in the fat and oil contents of presscakes produced under fairly consistent commercial conditions, and that the maximum expression of moisture is not necessarily linked with the maximum expression of oil. Differences in the quality and composition of presscake cannot be explained simply in terms of differences in cooking and pressing procedures or in terms of temperature differences.

It has been said that the quality of fish meal, especially with regard to nutritional values, is more dependent on good drying than on satisfactory cooking and pressing. During the year, the Institute initiated studies of the conditions prevailing in fish meal driers, in an effort to gain further insight into this problem, and several interesting observations were made. The rate of removal of moisture in a 60 ft. direct rotary drier was highest in the first eleven feet of its length (about 3 per cent per ft.) but dropped to one-tenth of this amount (0.35 per cent per ft.) in the last 27 ft. A big drop in the temperature of the fish mass, of the order 55°F, was also observed in the first eleven feet of the drier and was thought to be largely due to rapid evaporation of moisture.



in die eerste 11 vt. van sy lengte (omtrent 3 persent per voet) dog het tot een tiende van hierdie waarde (0.35 persent per vt.) in die laaste 27 vt. verminder. 'n Groot daling ongeveer 55°F, in die temperatuur van die vismassa is ook in die eerste 11 voet van die droër waargeneem en dit was vermoedelik grotendeels te wyte aan die vinnige vogverdamping.

Werk in verband met die selfverhitting van vismeel is gedurende die jaar voortgesit en uitgebrei. Besondere aandag is bestee aan die uitwerking van intrinsieke verskille tussen vismeelsoorte op hul selfverhittingstempo en aan maontlike metodes om daardie tempo te verlaag.

'n Reeks proefnemings is uitgevoer met gebruikmaking van die adiabatiese kalorimeters wat in vorige verslae beskryf is. 'n Vorige bevinding dat gewone vismeel meer reaktief is as volmeel van dieselfde vis onder presies dieselfde toestande gemaak, is weer bevestig. Verdere staving van 'n seisoenverskil in die selfverhittingstempo is ook verkry: die selfverhittingstempo van meel gedurende die voorjaar (September en Oktober) berei was baie laer as by meel gedurende die tydperk Februarie tot Julie vervaardig.

Navorsing is gedoen om te bepaal of daar maontlik 'n verband bestaan tussen die voggehalte van 'n vismeel, sy vetgehalte (deur hekasaan) en sy selfverhittingstempo, dog geen duidelike beeld kon verkry word nie.

Wat die metodes om die selfverhittingstempo te verminder betref, het 'n reeks proefnemings om die uitwerking van vertraagde maling van meel te ondersoek, aangetoon dat weinig of geen voordeel uit die veroudering van meel in 'n growwe toestand getrek kan word nie. Die byvoeging van 'n antioksideermiddel by 'n meel van 6 dae oud was het die selfverhittingstempo tot ongeveer 72 persent van die onbehandelde meel verminder, dog hierdie betreklike klein voordeel was nouliks die betrokke uitgawes werd. Die gebruik van anti-oksiedeermiddels op vars-gemaalde meel word egter bestudeer en voorlopige toetse dui daarop dat voorverhitting van meel en die meng van reaktiewe meel albei wesenlike verminderings in die selfverhittingstempo teweeg bring. Hierdie bevindings sal verder ondersoek word.

Die Instituut het nog steeds met die Afdeling Visserye saamgewerk in hul sardynmerkprogram en gereelde toetse en inspeksies op magnetiese opspoorstelsels in vismeelfabrieke uitgevoer om hul doeltreffendheid so hoog maontlik te hou.

Die produksie van vismeelblom volgens die V.N.N.I. se metode en onder die algemene toetsing van die Instituut is dwarsdeur die jaar by die proefinstallasie voortgesit. Die produk is gebruik vir die verryking van growwe brood in die Westelike Provinsie en die ontvangs wat hierdie nuwe tipe brood onder die publiek geniet het, was baie bevredigend. Laboratoriumwerk in verband met die produksiemetodes is teen die einde van die jaar meer intensief uitgevoer en is nou amper voltooi. 'n Volledige verslag sal opgestel word.

Work on the spontaneous heating of fish meal was continued and extended during the year. Particular attention was given to the effect of intrinsic differences between meals on their rates of heating and to possible methods of reducing the rate of heating. A series of experiments was carried out, using the adiabatic calorimeters, described in earlier reports. A previous finding, that ordinary meals are more reactive than full meals prepared from the same fish under the same conditions, was again confirmed. Further confirmation of a seasonal variation in the rate of heating was also obtained, the rate of heating in meals prepared during the spring (September and October) being much lower than in meals manufactured during the period February to July.

The possibility that a relationship exists between the moisture content of a meal, its fat content (by hexane) and its rate of heating was investigated, but no clear picture could be obtained. On present data there appears to be no correlation between hexane fat content and rate of heating.

In regard to methods for reducing the rate of heating a series of experiments to investigate the effect of delayed milling of meal, indicated that little, if any, advantage was to be gained by the curing of meal in an unmilled state. The application of an anti-oxidant to a six-day-old meal reduced the rate of heating to about 72 per cent of that of the untreated meal, but this relatively small advantage did not appear worth the expense involved. The use of anti-oxidants on freshly-manufactured meal, however, is being studied and preliminary tests indicate that pre-heating of meal and the mixing of reactive meals both result in substantial reductions in the rate of heating. These findings will be further explored.

The Institute continued to co-operate with the Division of Fisheries in their pilchard-tagging programme and carried out regular tests and inspection of magnet recovery systems in fish meal plants in order to maintain their efficacy at the highest possible level.

The production of fish flour by the F.I.R.I. method, and under the general supervision of the Institute, continued at the pilot plant throughout the year. The product was used for the enrichment of fortified brown bread in the Western Province and public acceptance of this new type of loaf has been most satisfactory.

Laboratory work in connection with production techniques was intensified towards the end of the year and has now been virtually concluded. A full report is to be prepared.

As in past years, routine inspections and chemical and bacteriological analyses were carried out by the Institute.



Net soos in die verlede is roetine-inspeksies en chemiese en bakteriologiese analises deur die Instituut uitgevoer. Die nywerheid maak in toenemende mate van die geriewe en dienste wat beskikbaar gestel word, gebruik.

#### **Publikasies**

Gedurende 1957 het die Instituut ses vorderingsverslae, vyf memoranda, vyf bulletins, vier literatuuropsommings en twee gemengde publikasies uitgegee.

### **NAVORSINGSINSTITUUT VIR DIE LEERNYWERHEID**

*Direkteur: DR. S. G. SHUTTLEWORTH*

Gedurende die afgelope jaar het die personeel van die Instituut dit bemoedigend gevind dat die resultate van hulle werk ook oorsee gebruik word. Verskeie Britse, Duitse, Australiese en Nieu-Seelandse nyweraars het dit byvoorbeeld lonend beskou om die onkoste te betaal van lede van die personeel wat na hul onderskeie lande gekom het om hulle met tegniese hulp by te staan in verband met patente wat deur die N.I.L.N. uitgeneem is en wat in toenemende mate oorsee in gebruik geneem word.

Die onlangse oorsese besoek deur die direkteur het hom in staat gestel om verbinding met verskeie Britse en Europese navorsingsorganisasies wat werk onderneem in verband met skoeisel en leer, te henuwe. Dit was besonder bemoedigend om op te merk hoe die werk van die Instituut, oor die algemeen erken word en ook om waar te neem hoeveel byval ons vordering in die fundamentele en praktiese aspekte vind. Hierdie wydverspreide belangstelling in die navorsingswerk van die Instituut is bevestig deur die talryke oorsese versoeke om afdrukke van verhandelinge en ander informasie wat uit baie lande, met inbegrip van dié agter die „Yster gordyn” ontvang is.

#### **Fundamentele Navorsing**

Die belangrike vordering in die fundamentele werk op plantaardige looistowwe van ongeveer 'n jaar gelede, is gedurende die afgelope periode opgevolg deur verdere bevestigende studies en oorsese publikasie. Die identifikasie van sekere van die „boustene” van 'n verskeidenheid „gekondenseerde” looistowwe afkomstig van inheemse en ingevoerde loofhoutsoorte is voltooi, en nuwe informasie is verkry in verband met die struktuur en molekulêrgewigverspreiding van wattelbaslooiestof, een van Suid-Afrika se hoofbronne van ongesubsidieerde uitvoerhandel. Die manier waarop die looistowwe as enkele eenhede in die boom begin, om daarna deur ensieme in komplekse looistowwe omgesit te word, word nagegaan, en dit het ook geblyk dat hierdie transformasie horisontaal van die kambium na die kernhout of van die kambium na die bas plaasvind. In die geval van wattelbas is hierdie ensiematiese werking skynbaar baie vinnig en

The industry is making increasing use of the facilities and services provided.

#### **Publications**

During 1957, the Institute issued six progress reports, five memoranda, five bulletins, four literature summaries and two miscellaneous publications.

### **LEATHER INDUSTRIES RESEARCH INSTITUTE**

*Director: DR. S. G. SHUTTLEWORTH*

The staff of the Institute has drawn much encouragement from overseas utilization of the results of their work. For example, various British, German, Australian, and New Zealand industrialists considered it profitable to pay the expenses of members of the staff to travel overseas in order to assist them in the technical problems of marketing products for their footwear industries arising from L.I.R.I. patents which are being exploited overseas in increasing quantity.

The recent overseas visit of the Director enabled him to renew contacts with the various British and European organizations carrying out research in the footwear and leather field, and it was rewarding to find such recognition of the work of the Institute and the general acceptance of advances in fundamental and practical fields originating from the South African Leather Research Organization. This has been confirmed by the number of requests for reprints and other information from all countries including those behind the “Iron Curtain”.

#### **Fundamental Research**

The major breakthrough in fundamental tannin chemistry, achieved a year ago, was followed up actively during the current year by further confirmatory studies and overseas publication. The identification of the main building blocks of a variety of condensed tannins from local and imported hardwoods is proceeding, and much light has been thrown on the structure and particle size distribution of wattle tannin, which is one of South Africa's major sources of unsubsidized export trade. The manner in which these tannins are laid down in the tree as single units and then polymerized by the enzymes of the tree into larger bodies is being traced, and it has been shown that this takes place horizontally from cambium to heartwood and from cambium to outer bark layer. In the case of wattle this enzyme action has been shown to be rapid, thus explaining the absence of vertical differences in the tree caused by differing ages of growth.



dit verklaar die afwesigheid van verskille in baslooiestof-komponente verkry van monsters van verskillende hoogtes bo die grondoppervlak.

Waardevolle werk in verband met die oplosbare proteïene van huide en velle, wat 'n hoofrol in die bereiding en vroeë looistadia speel, is uitgevoer. 'n Apparaat vir elektroforese is in gebruik geneem om die hoeveelhede en tipes oplosbare proteïene aanwesig in die velle van jong en ou diere van verskillende varieteite en rasse, te bestudeer, en om die gevolge van bereidingsmetodes op die onomkeerbare onoplosbaarmaking van hierdie proteïene te ondersoek. Die publikasie in oorsese tydskrifte van 'n deel van hierdie werk deur die instituut, het baie belangstelling gewek.

Fundamentele werk is gedoen op die looiwerking van plantaardige looistowwe en ook op die looireaksie van nuwe epoksieharse. 'n Vergelykende studie van die bestendigheid van chroomkomplekse deur verskillende aminosure gevorm nader die publikasiestadium. Fundamentele navorsing word ook gedoen in verband met die komplekse wat tussen sirkoniumsoute en die soute van organiese sure gevorm word. Hierdie studies is nou verwant aan die werking van verskillende looioprosesse, en word nodig beskou om die looiwyerheid van 'n tradisionele ambag in 'n chemiese industrie te verander, en om sodoende beter die mededinging van surrogate die hoof te bied.

Basiese navorsingswerk vir die skoelwyerheid dek 'n opname van voetvorms van verskeie ouderdoms-, rasse-, en beroepsgroepe. Hierdie werk gedurende die afgelope jaar was van besonder groot belang omdat die uitwerking van skoendrag op die vorm van die voet daardeur bewys is. In die geval van jong dames is byvoorbeeld vasgestel dat duidelike veranderinge in die boog van die middelste gedeelte van die voet plaasvind wanneer hulle tot die gebruik van hoëhakskoene oorgaan. Vergelykende studies van voetvorms by blanke en nie-blanke kindergroepe het bewys dat die grootste verskille nie volgens ras is nie, maar nader verwant is aan kaalvoetloop en skoendragewoontes. Die skoendragewoonte veroorsaak belangrike veranderinge in die spiere en vleisagtige gedeeltes van die voetsool. Bogemelde werk dien as leidraad in verband met die ontwerp van leeste vir die belangrikste verbruikersgroepe.

#### **Huide- en Vellenwyerhede**

Die Adviesraad van die Karakoelbedryf het besluit om finansiële steun aan 'n werkprogram vir die ontwikkeling van 'n gesamentlike bakterieë- en insektedodende middel te verleen, as gevolg van voorlopige werk op die bereiding van karakoelvelle. Die gesogte middel is nodig vir gebruik in die waswater waarin die velle gedompel word voor die droogmakingsproses.

'n Belangrike praktiese ontwikkeling uit die fundamentele navorsing in verband met huide en velle is die moontlikheid van die vervaardiging van leer van besondere lae digtheid. 'n Verdere ontwikkeling is die ver-

Useful long range work was also conducted on the soluble proteins of hides and skins, which play a major role in curing and in the early stages of tanning. An electrophoresis apparatus was installed for studying the quantities and types of soluble proteins present in skins of young and old animals and in animals of different varieties and breeds, and for examining the effects of curing methods on the irreversible insolubilization of these proteins. Overseas publication of some of this work by the Institute has aroused much interest.

Fundamental work was carried out on the mechanism of vegetable tannage and on the tanning action of the new epoxy resins. A further comparative study on the stabilities of the chromium complexes formed by various amino acids is nearing the publication stage. Fundamental investigations are also being pursued on the complexes formed by zirconium salts with salts of organic acids. These studies related to the mechanisms of various tanning processes are believed to be essential steps in the conversion of the tanning industry from a tradition-hampered craft to a modern chemical industry capable of meeting competition from synthetics, with initiative based on a lucid understanding of the processes involved. Long range work for the footwear industry is mainly related to surveys of the foot shapes of various age, racial and occupational groups. Work in this field during the past year was of special interest in proving the effects of shoe wearing on foot shape. In the case of girls' feet, surveyed several years before and after changing over from flat maids' shoes to higher heeled adult footwear, marked changes in the arch instep region were shown to occur. Group comparative studies on European and non-European children's feet of non-shoe wearing and shoe-wearing habits, showed the major differences are not racial but are related to shoe wearing, which causes major changes in the muscle and fleshy pads of the foot. This work serves to guide policy in regard to design of lasts for the main consumer groups.

#### **Hides and Skins Industries**

As a result of preliminary work on the curing of Karakul skins, the Karakul Industry Advisory Board decided to give financial support to a programme of work on the development of a combined bactericidal/insecticidal agent for use in the wash waters into which the skins are dipped prior to drying.

An important practical development arising from fundamental research on hides and skins was the development of a new low density leather. Another development



klaring van waarnemings in verband met die onomkeerbare reaksies van sekere proteiene wanneer hul aan drasiese droogmaakmetodes en die invloed van sekere ontsmettingsmiddels onderwerp word. Eksperimentele werk op die kunsmatige droëng van velle is uitgevoer, en die bevindings is reeds prakties deur huide- en vellebereiders in die Kaapse skiereiland waar die winterreëns natuurlike droogmaak bemoeilik, toegepas. Werk in verband met die verwydering van vleis van huide by die slagpale sal vermoedelik tot 'n vinniger en meer eenvormige bereidingsmetode lei. Die 15-25 persent ongewenste vleis en vet wat verwyder word, bied kommersiële gebruiksmoontlikhede, en hul aanwesigheid verhoed bowendien die deurdring van bereidingsmiddels. Toetsstapels het veelbelowende resultate by die verskillende looiproewe opgelewer.

Die werk in verband met die ondersoek van nuwe insektegifte vir bereiding is voortgesit. Besoeke is by die meeste firmas gebring om raad in verband met die toepassing van bereidingsmetodes te gee, en 'n spesiale kursus is gereël vir 26 huide- en vellegradeerders van die Vee- en Vleisbeheerraad.

Gegewens word versamel vir die publikasie van 'n handleiding in verband met die Suid-Afrikaanse huide- en vellenywerheid.

#### **Wattel- en Looinywerhede**

'n Nuwe tipe leer van besondere ligte gewig is deur die Instituut ontwikkel en die proses is deur 'n voorlopige patent gedek. Hoewel die digtheid daarvan ongeveer een derde van gewone sool leer is, het slytproewe bewys gelever van heelwat minder slytasie in vergelyking met gewone leer met plantaardige looistowwe gelooi. Bemoeidende resultate is ook verkry deur die toepassing van hierdie bereidingsmetode op pelse. 'n Proefskaaalse ontwateringsapparaat word gebou om die koste van die proses te bestudeer, om moontlikhede wat betref liggewigkofferleer te ondersoek, en om die fisiese eienskappe van die nuwe leertipe vas te stel.

Die sluiting van 'n aantal oorsese sool leerlooierye het die dreigement van rubber en sintetiese sool materiale beklemtoon. Hierdie onderwerp was die hooftema van die Internasionale Konferensie van Leerchemici in Rome, wat die Direkteur van die Instituut in September 1957 bygewoon het. Die Konferensie het die dringende noodsaaklikheid vir genoegsame uitgawes vir leernavorsing beklemtoon. Die resultate van werk in verband met nuwe vinnige en ekonomiese metodes vir die produksie van hoëgraadse wattelbasgelooid leer, is beskryf in 'n verhandeling aan die konferensie gelever. Daaropvolgende navrae het aangedui dat die Fosfaatosmotanproses deur die Instituut ontwikkel binnekort in Europa uitgetoets sal word. Hierdie looimetode is reeds in algemene gebruik in Suid-Afrika en Australië. Proefskaaalse werk en grootskaalse toetse in verband met die gebruik van wattel ekstrak vir die looi van sool leer is gedurende die hele jaar volgehou.

was in clarifying observations on the irreversible action of drastic drying methods and certain disinfectants on some of the proteins present. Experimental work was carried out on artificial drying of skins, and results are already being put into practice by curers in the Cape, where winter rains render natural drying difficult.

Work carried out on green fleshing of hides at the abattoirs gave promise of a method of more rapid and more uniform curing combined with commercial usage of the 15 to 25 per cent unwanted adhering flesh and fat which blocks the penetration of curing agents. Test packs showed great promise in tannery trials.

Work continued on the testing of new insecticides for curing. Visits were paid to most curing firms to advise on curing methods and a special training course was conducted for 26 hides and skins graders of the Livestock and Meat Industries Control Board.

Data is being collected for the publication of a handbook on the South African hides and skins industry.

#### **Wattle and Tanning Industries**

A new type of very light weight leather was developed and the process covered by Provisional Patent. In spite of a density of only one third of that of normal sole leather, wear trials indicated considerably better wear than the usual vegetable tanned leather. Promising results were also obtained in using the method for fur processing. A pilot plant is being constructed to study processing costs, to explore potentialities in such fields as light weight luggage leather and to examine the physical properties of the new type of leather.

The closing of a number of overseas sole leather tanneries has emphasized the threat to leather by rubber and synthetic soling materials, a subject which formed the main theme of the Rome International Conference of Leather Chemists Societies, attended by the Director in September, 1957. The Conference stressed the vital need for adequate expenditure on leather research. Results of work on new rapid economical methods of high grade wattle tanned sole leather production were delivered in a paper to the Conference, and subsequent queries indicated that the L.I.R.I. developed Phosphate Osmotan process will be tried out in Europe. The method is already in extensive use in South Africa and Australia. Pilot plant work and large-scale trials on wattle tannage of sole leather continued throughout the year.

Pilot plant work and large-scale trials continued on methods of reducing water solubles in outersole leather, and on impregnation with waxes and synthetics for improvement of wear. Combination tannages for sole leather are also being explored.



Proefskaaalse werk en grootskaalse toetse is voortgesit om die oplosbare materiaal in buitesooller te verminder, en om verbeteringe in slytasie gedurende gebruik teweeg te bring deur impregnering met was en sintetiese stowwe. Kombinasielooimetodes vir sooldeer word ook ondersoek.

Proefskaaalse navorsing met die gebruik van wattelbas-ekstrak by die nalooiing van chroomleer het 'n hoë mate van voorkeur gedurende die afgelope jaar geniet. Hierdie werk beoog die uitskakeling van die tipiese verlies aan sterkte na die verbinding van die hoogs aktiewe wattelooistof met chroom. Verskeie faktore is nagegaan en 'n paar wat bydra tot verhoogte sterkte en verduurzaamheid, is opgespoor. 'n Beter idee is verkry van die reaksies wat hiermee gepaard gaan, en daar word vertrou dat die werk tot 'n groter vraag na wattlekstrak sal lei. Boleervervaardiging is sover nog nie deur die gebruik-neming van surrogate bedreig nie.

Spesiale werk om leer vir die vervaardiging van stewels vir mynwerkers waterdig te maak, is uitgevoer. Hierdie steweltipe is veral noodsaaklik vir gebruik in die nat goudmyne van die Vrystaat.

Proefskaaalse en grootskaalse toetse in verband met die kalkingsproses het bemoedigende resultate opgelewer sowel wat tydverkorting betref as by die verwydering van ongewenste looieryafvloeiensels. Die kalsiumsulfiedinhoud van looieryuitvloeiensels is normaalweg baie skadelik en moeilik om te behandel.

#### **Skoeisel**

Gedurende 1957 is daar al hoe meer gebruik van die Instituut se „Liripuff”-proses vir die verstewiging van neuse en hakke van skoene gemaak sowel plaaslik as oorsee. Die firma Liri Components, die Maatskappy wat deur die Federasie van Suid-Afrikaanse Skoeiselfabrikante in die lewe geroep is om die proses te eksploiteer, het meer as 112,000 jaart bewerkte materiaal aan die skoennywerheid verskaf, terwyl die firma Poly Resin Products byna honderd ton „Liripuff”-harpuise gelewer het, waarvan 'n gedeelte sonder lap gebruik word.

'n Noemenswaardige vooruitgang was die ontwikkeling van 'n nuwe harpui vir harde neus- en hakverstywings wat in besonder die hele aanwending van die proses aansienlik vergemaklik het. Die nuwe materiaal vind groot byval, en in Engeland word verbeterde outomatiese masjinerie daarvoor vervaardig deur die Instituut se Britse lisensiehouer. Verdere belangrike werk op die gebied is die ontwikkeling van 'n selfvormende sintetiese harpui-hakverstywing, wat tot 'n beter hakfatsoen bydra, en gemakliker aan die voet sit, terwyl dit in die fabriek die gebruiklike groot verskeidenheid voorrade van voorafgevormde hakverstywings heeltemal uitskakel. Op hierdie gebied is die S.A. skoeiselnwyerheid tans toonaangewend.

Waardevolle diens in verband met die opstelling van kwaliteitstoetse en standaarde vir skoeiselmateriale word in Engeland gelewer deur die Britse SATRA, en die leiding vind navolging in die Instituut, met spesiale verwysing tot

Pilot plant work on the use of wattle in retannage of chrome leather received high priority with a view to eliminating the loss of strength arising from the combination of the highly active wattle tannin with the chromium. Various factors were tested and a number of these were found to contribute to increased strength and grain durability. A much clearer picture has been formed of the reactions involved and there is every hope that this work will lead to valuable additional markets for wattle in upper leather manufacture, a field which is not yet threatened by synthetic substitutes.

Special work was carried out on waterproofing leather for miner boot construction to assist the wet mines, particularly in the Free State.

Pilot plant and large scale work on liming methods gave promising results both in regard to economics in time as well as in the direction of effluent disposal, the lime sulphide content of effluents being the most noxious and difficult to deal with.

#### **Footwear**

During 1957, the utilization of the Institute's "Liripuff" process for stiffening toes and heels of footwear continued to expand both locally and overseas. Messrs. Liri Components, the company formed by the South African Footwear Manufacturers' Federation to exploit the process, supplied over 112,000 yards of treated material to the footwear industry while Messrs. Poly Resin Products sold nearly 100 tons of "Liripuff" resins, a proportion of which is used without fabric. Further progress was made during the year in resin formulation, leading to a new resin blend for hard toepuff and stiffeners which has been welcomed both by South African and overseas users of the process. This new resin has given rise to simplification of application in the factory, and the British franchise holder is designing more automatic applicator machines. The main work in this field has been in the development of self moulding synthetic resin heel stiffeners, in order to achieve better heel shapes, improved foot comfort and elimination of multiple stocks of premoulded stiffeners to match all sizes and shapes of lasts. This work has enabled the South African footwear industry to lead the field in these aspects of footwear construction.

The Institute is following the successful example of the British Shoe and Allied Trades Research Association in developing quality tests for all the various components of the shoe and in encouraging factories to improve quality by comparing qualities of alternative materials



faktore wat voetgesondheid en gemak affekteer. Die nywerheid is gehelp deur die opstelling van vrywillige gebruikskodes.

Werk word ook verrig op die gebied van bedryfsskoeisel naamlik vir mynwerkers en die leër, asook veiligheids- en voetbalstewels. Die werk sluit in opnames van voetvorms, die ontwerp van nuwe leeste, veiligheidstewels met neuse van glasvesel-poliester- en epoksiharslamelle, en die toets van nuwe konstruksiemetodes en materiale om slyteien-skappe te bepaal.

### **Bedryfsnavorsing**

Bogemelde fabrieksproewe van nuwe materiale en metodes behoort eintlik onder hierdie afdeling, maar daarbenewens is 'n begin gemaak met sogenaamde „Ergonomie” waarmee die Britse SATRA weer eens baie sukses gehad het. Die werk sluit verskeie doeltreffendheidsmetodes in, en vanweë die groot veld wat deur die beperkte staf gedek moet word, is die werk op die oomblik gerig op die instruksie van fabrieksbeamptes, en 'n kursus van lesings en films word op die oomblik aan die Port Elizabethse Tegniese Kollege gegee.

Die Instituut het voortgegaan met die versameling van statiese gegewens omtrent die skoeisel- en looinywer-hede en verskaf ook meer inligting oor handelsneiginge „Footwear Facts and Figures 1917-1957” en „Statistics of the S.A. Tanning Industry 1953-1957” bevat versamelde inligting insake produksie, verbruik en arbeidsneiginge, en dien as 'n handige beplanningsgids vir nywer-aars.

### **Publikasies**

Gedurende die afgelope jaar het die Instituut twaalf verhandelinge in oorsese wetenskaplike tydskrifte laat verskyn, en een-en-twintig in Suid-Afrikaanse tydskrifte; benewens vyftien gedrukte en drie-en-twintig mimeografiese verslae.

## **VERFNYWERHEIDNAVORSINGSINSTITUUT**

*Direkteur: G. M. HAMILTON*

Gedurende die jaar is 'n opsomming van die resultate gemaak wat verkry is in die loop van die eerste vier jaar waarin sekere verfsoorte aan die buitelug blootgestel is, en die verslag is aan die industriële lede van die Instituut gestuur. Met voldoening kan melding gemaak word van die bevredigende gedrag van die sinkoksiede, chroomgeel, en groen en rooi oksiede wat in Suid-Afrika vervaardig is. Party van die verve wat hierdie pigmente bevat, is na vier jaar se blootstelling nog heeltemal in 'n goeie toestand.

Wat verfmedia betref was sekere alkiiede en gestire-

available. In this work factors affecting foot health and comfort are emphasized. The industry has been assisted to establish voluntary minimum codes of practice.

Work was also carried out on various occupational types of footwear, including miner, army, safety and football boots. This work includes foot shape survey, design of new lasts, protective toecaps using glass fibre polyester and epoxy resin laminates, and wear trials to test special constructional developments and alternative components.

### **Operations Research**

In addition to numerous factory trials of new technical ideas mentioned in the above three sections which could be described as operations research, the Institute has taken an interest in the field of “ergonomics” or work and motion economy, following the success of British SATRA in this field. The limited staff available for this work made it necessary to depend largely on factory executives for practical use of principles demonstrated by means of motion study cine films and lectures. A start was made on the preparation of films, and a course of lectures is being given to factory executives.

The Institute continued to collect and collate the statistics of the footwear and tanning industries and to render prompt information to the industry on production trends. The publication of Footwear Facts and Figures 1917-1957 and of Statistics of the South African Tanning Industry 1953-1957, set a high standard of collated statistical information on production, consumption and employment trends, and provided factories with a background for future planning.

### **Publications**

During the past year, the Institute contributed 12 papers to overseas scientific journals, 21 to South African journals and published 15 printed and 23 mimeographed reports.

## **PAINT INDUSTRIES RESEARCH INSTITUTE**

*Director: G. M. HAMILTON*

A summary was made and circulated to industrial members of the Institute of the results obtained from the first four years of the exterior exposure of certain paints. It is gratifying to be able to report the satisfactory behaviour of the South African produced zinc oxides, chrome yellows and greens, and red oxides. Some paints containing these pigments are in quite good condition after four years of exposure.

In regard to paint media, certain alkyds and styrenated alkyds have been very satisfactory, while segregated



neerde alkiede baie bevredigend, terwyl gesegregeerde sonblomsaadolie baie goeie resultate opgelewer het. Hierdie olie kan verbeter word deur toevoeging van houtolie en/of gereduseerde fenolharse. Verdere werk met sonblomsaadolie plus 100 persent fenolhars lyk baie belowend.

Na afloop van vier jaar was slegs twaalf van die korrosiekerende grondverwe as 'n enkellaag getoets, nog ongesonde.

Rooimenie wat hoofsaaklik volgens Britse Standaardspesifikasie 1011 gemaak is, was buitengewoon goed, terwyl die toevoeging van rooi oksied by rooimeniegrondverf baie bevredigend in sintetiese media was. Hierdie grondverwe wat saam met 'n deklaag getoets word, is baie stadig om resultate op te lewer en daar moet nog 'n bietjie gewag word voordat goed beoordeel kan word watter van hulle die beste is. Onbevredigende resultate is met loodtitanaat en loodsianamied verkry.

Die oorspronklike program in verband met korrosiewerende grondverwe is uitgebrei deur nog 97 formuleerings bloot te stel maar behalwe dat die swak prestasie van loodtitanaat en -sianamied herhaal is en dat ook swak resultate met sekere formules deur die British Iron and Steel Research Associations aanbeveel in die toestande wat in ons land heers, verkry is, is dit nog te vroeg om die resultate op te som.

Die werk in verband met formules deur die Badische Anilin und Soda Fabrik uitgewerk, is afgehandel en verslag daaromtrent is aan lede gedoen. Oor die algemeen was die resultate min of meer soos verwag is uit onderverinding deur die Instituut opgedoen. 'n Grondverf met 'n basis van karbamiedhars en sinkchromaat het beter gepresteer as die konvensionele etsgrondverf.

Gedurende 1957 is 'n begin met 'n aantal verdere ondersoeke in hierdie reeks gemaak. Die konsentrasie pigment/volume in die geval van 'n aantal pigmente word nagevors en ook is daar begin met werk in verband met fenolharse.

Die eerste tydperk van 'n verflaag se lewe is belangrik en in 'n poging om vas te stel in watter mate dit die verdere prestasie van die laag affekteer, is 'n begin gemaak met die blootstelling van 35 verwe met tussenpose van twee maande. Die duidelike verskil tussen die somer- en die winterklimaat in Durban is ideaal vir hierdie soort ondersoek.

Hierdie lys is lank nie volledig nie maar dit is die moeite werd om daaraan te herinner dat sedert die aanvang van hierdie reeks ondersoeke 806 verwe gemaak en 2,555 panele blootgestel is. Die ooreenstemmende syfers vir die afgelope 12 maande is onderskeidelik 115 en 455.

Behalwe met bovermelde aangeleenthede hou die Instituut hom tans ook besig met navorsing in verband met die gebruik van swamdoedende middels in verf waarvoor 'n vinnige sorteertoets uitgewerk is om te bepaal in watter mate swamme in 'n verflaag kan groei; die deurgang van metielbromied deur verflae, vanweë die belangstelling van verskeie kante in 'n verf waarmee

sunflower seed oil has given very good results. This oil can be upgraded by the addition of wood oil and/or reduced phenolic resins. Further work with sunflower oil plus 100 per cent phenolic resin appears very promising.

At the expiration of four years only 12 of the corrosion inhibitive primers, tested as a single coat, still survived. Red lead, substantially in accordance with British Standards Specification 1011, was extremely good, while additions of red oxide to red lead primers proved satisfactory in synthetic media. These primers tested with a top coat are very slow in yielding results and some time must yet elapse to get a real assessment of the better performers among them. Unsatisfactory results were obtained with lead titanate and with lead cyanamide.

The original programme on anti-corrosive primers has been supplemented by the exposure of a further 97 formulations, but except that the indifferent performances of lead titanate and cyanamide were repeated and that poor results were obtained on certain formulae recommended by the British Iron and Steel Research Association under conditions in this country, it is too early to summarize results.

The work carried out on formulations developed by Badische Anilin und Soda Fabrik was concluded and reported to members. In general the order of the results was much as anticipated from experience gained at the Institute. The performance of a primer based on carbamide resin and zinc chromate was better than that of the conventional wash primer.

During 1957, a number of further investigations in this series were initiated. Pigment/volume concentration is under examination for a number of pigments, while further work on phenolic resins was begun.

The early life of a paint film is important, and in an endeavour to find out how far this affects the subsequent performance of the film, exposure of 35 paints was started at two-monthly intervals. The sharp differentiation in the summer and winter climate of Durban is ideal for this type of investigation.

This list is far from exhaustive, but it is worth recording that, since this series of investigations was started, 806 paints have been made and 2,555 panels have been exposed. The corresponding figures for the last 12 months are 115 and 455 respectively.

Current work, in addition to the items mentioned above, includes research into the use of fungicides in paints for which a rapid sorting test has been developed to assess the liability of paint film to support mould growth; the transmission of methyl bromide through paint films, in view of the interest evinced from several quarters in a paint capable of sealing silos against leakage of methyl bromide fumigant; the practical evaluation of traffic paints, in which the Provincial Administration is assisting the Institute to lay down experimental bands of



graansuiers teen die uitlek van metielbromiedberokingsmiddels verseël kan word; die praktiese waardebeplanning van verkeersverve waarby die Provinsiale Administrasie die Instituut help met die aanbring van proefbande verkeersverf om dit in praktiese toestande te toets; die beoordeling van aangroeiwerende verf op skepe waarvoor die seelugbloomstelsels in die Durbanse hawe uitgebrei moes word; 'n ondersoek na die verband tussen die skoonmaak van gegalvaniseerde yster en die adhesie van verskillende verve daaraan wat eintlik meer die invloed van skoonmaakmetodes op die adhesie van verfstelsels aan gegalvaniseerde yster betref as die aanbring van afsonderlike lae; verve wat teen 'n hoë temperatuur bestand is en media bevat met gemaalde keramiekfritte in plaas van gewone pigmente wat feitlik glasuuremalje op yster vorm wanneer die temperatuur hoog genoeg styg; en ondersoek om te bepaal in hoeverre wattlekstrak wat so geoksideer kan word dat dit 90 persent organiese suur van 'n baie ligte kleur oplewer, as grondstof gebruik kan word. Die identifisering van hierdie suur vir moontlike gebruik in alkiedreaksie of in plastiseermiddels duur voort.

#### SUIKERFABRIKASIE-NAVORSINGSINSTITUUT

*Direkteur:* DR. K. DOUWES DEKKER

Die drie hoofonderwerpe tydens die verslagtydperk ondersoek, was die ekstrahering van sukrose uit suikerriet; die bepaling van die sukroseinhoud van afsonderlike besendings suikerriet en die gehalte van die rusuiker-soorte van Natal. Daarbenewens het die Instituut sy aandag aan 'n aantal minder belangrike onderwerpe gewy—die meeste hiervan het betrekking op die genoemde daaglikse probleme van die nywerheid.

Roetinedienste is soos vorige jare aan lede gelever. Hulle was o.a. die chemiese en fisiese ontleding van produksiemonsters suiker en die bepaling van die polarisering van monsters uitgevoerde rusuiker. Verslae oor die gehalte van die geproduseerde suiker is gereeld aan die Natal Sugar Association voorgelê. Monsters eindmelasse en tussenprodukte is ook ontleed.

Raadgewing het heelwat van die personeel se tyd in beslag geneem. Agt-en-veertig besoeke is aan suikerfabrieke gebring en vyf-en-dertig tegniese verslae is hoofsaaklik namens die fabrieke opgestel.

Weeklikse en maandelikse verslae i.v.m. vervaardigingsgegewens is weer gepubliseer, en die jaarlikse opsomming van chemiese en laboratoriumverslae is saamgevat in die *Proceedings of the S.A.S.T.A. Congress*. Ses verhandelings is in die reeks „Communications from the S.M.R.I.” gepubliseer, en vyf lesings is deur lede van die Instituut se personeel op die Jaarkongres van die South African Sugar Technologists Association gegee.

'n Begin is gemaak met die publikasie van 'n „Quarterly Bulletin” as deel van die Januarie-, April-, Julie- en Okto-

traffic paint for test under practical conditions; the evaluation of ships' anti-fouling paints for which the marine exposure station in Durban harbour has been extended; an investigation into the relation between cleaning galvanized iron and the adhesion of different paints to its surface, which is concerned with the influence of cleaning methods on the adhesion of paint systems to galvanized iron rather than the application of single coats; high temperature resistant paints in which paint media containing ground ceramic frits in place of ordinary pigments will virtually form vitreous enamel on iron when the temperature gets sufficiently high; and research into possible uses of wattle extract as a raw material which can be oxidized to give a yield of 90 per cent organic acid of very pale colour. The identification of this acid for possible use in alkyd reaction or in plasticizers is proceeding.

#### SUGAR MILLING RESEARCH INSTITUTE

*Director:* DR. K. DOUWES DEKKER

The three main subjects investigated were the extraction of sucrose from cane, the determination of the sucrose content of individual consignments of cane, and the quality of Natal raw sugars. In addition, the Institute dealt with a number of smaller items, most of them related to the so-called day-to-day problems of the industry.

As in previous years, routine services were provided for members. These included the chemical and physical analysis of production samples of sugar, and the determination of the polarization of samples of exported raw sugars. Reports on the quality of the sugar produced were submitted regularly to the Natal Sugar Association. Samples of final molasses and intermediate products were also analysed.

Advisory work continued to occupy a considerable portion of the time of the staff of the Institute. Forty-eight visits were paid to sugar factories and fifty-three technical reports were prepared, mainly on behalf of the factories.

Weekly and monthly reports on manufacturing data were again published and the annual summary of chemical and laboratory reports was prepared for publication in the *Proceedings of the S.A.S.T.A. Congress*. In the series “Communications from the S.M.R.I.”, six papers were published and five papers were read by the staff of the Institute at the Annual Congress of the South African Sugar Technologists' Association. Publication of a “Quarterly Bulletin” as part of the January, April,



beruitgawes van die *South African Sugar Journal*. Herdrukke van hierdie Bulletins word aan verkeie oersees firmas gestuur wat daarin belangstel.

### Die Ekstrahering van Sukrose uit Rietsuiker

#### *Diffusie*

Toe die 1956-eksperimente weer 'n keer nagegaan is, het aan die lig gekom dat 'n enkele horisontale skroef waarskynlik nie die doeltreffendste middel is om uitgeperste suikerriet deur 'n diffusietenk te laat gaan nie. Vedere toetswerk met 'n enkelskroefapparaat is gestaak.

Die gebruik van die vastelandse filtreerapparaat vir ononderbroke ekstraksie uit uitgeperste suikerriet is ondersoek. Uit die ondersoek het geblyk dat uitgeperste suikerriet nie 'n geskikte materiaal vir die toepassing van hierdie ekstraheringsproses is nie.

#### *Die Maalproses*

'n Statistiese ontleding van die gegewens i.v.m. die werking van No. 1 meule in Java is uitgevoer. Hierdie ontleding het tot nuttige gevolgtrekkings gelei waarvan heelwaarskynlik ook in ander lande gebruik gemaak sal kan word.

'n Proefondervindelike ondersoek i.v.m. die mate van opening van selle waarin sukrose bewaar word, is deur opeenvolgende meule begin. Die eerste vereiste vir suksesvolle suikerekstrahering is vanselfsprekend die breek van alle selle wat sap bevat, d.m.v. die drukwerking van die meul. 'n Ontledingstechniek vir die bepaling van die persentasie selle wat aldus ooggemaak word, is dertig jaar gelede op Java ontwerp. Die eerste stap in die huidige ondersoek was om die toepaslikheid van dié metode onder Natalse toestande te toets.

### Die Bepaling van die Sukrosegehalte van afsonderlike Besendings Suikerriet

Gedurende die verslagtydperk was daar 'n mate van vooruitgang m.b.t. die ontwikkeling van 'n geskikte metode vir die bepaling van afsonderlike suikerrietbesendings. Die sukrose-inhoud van alle besendings wat deur een van die tandemmasjiene gepers is, is tydens 'n voorlopige ondersoek in een van die fabriek deur die monsterneming en toetsing van elke besending bepaal. 'n Bevredigende ooreenstemming met die totale sukrose-inhoud van alle besendings—soos bepaal vir sukrose in gemengde sap plus sukrose in uitgeperste suikerriet—is verkry. Dit het egter geblyk dat sekere aspekte van die metode verder bestudeer moes word voor die praktiese toepassing van die tegniek aanbeveel kon word. Addisionele werk was dus o.a. die ontwikkeling van 'n outomatiese monsternemer vir suikerriet; die bepaling van water sonder Brix-waarde per centum vesel; en die ontwikkeling van 'n vinnige metode vir die bepaling van vesel in suikerrietmonsters.

### Die Gehalte van Rusuikers uit Natal

Baie raffinaderye in verskeie lande het die algemene ondervinding gehad dat rusuikers uit Natal moeilik is

July and October issues of the *South African Sugar Journal* was commenced. Reprints of these Bulletins are sent to various interested overseas addresses.

### The Extraction of Sucrose from Cane

#### *Diffusion.*

A re-appraisal of the 1956 experiments led to the conclusion that a single horizontal screw was unlikely to be the most efficient means of conveying bagasse through a diffusion tank, and further tests with a single screw apparatus were abandoned. The applicability to bagasse, of the use of a continental percolation type of continuous extraction apparatus was examined. From this investigation, it appeared that bagasse was not a suitable material to which to apply this extraction process.

#### *Milling.*

A statistical analysis was carried out of the data concerning the functioning of No. 1 mills in Java. This analysis provided useful conclusions, which can probably also be applied in other countries.

An experimental investigation was commenced into the degree of opening of sucrose-containing storage cells by consecutive mills. Obviously, the first requirement for the successful extraction of sucrose, by the queezing action of a mill is the rupture of all the juice-containing cells. In order to assess the percentage of cells which are thus opened an analytical technique was developed in Java thirty years ago, and the first step in the present investigation was to examine the applicability of the method under Natal conditions.

### The Determination of the Sucrose Content of Individual Consignments of Cane

Some progress was made in regard to the problem of developing a suitable method of evaluating individual consignments of cane. In a preliminary investigation, carried out at one of the factories, the sucrose content of all consignments crushed by one of the tandems was determined by sampling and testing each consignment. A satisfactory agreement with the total sucrose content of all consignments, as determined from sucrose in mixed juice plus sucrose in bagasse, was obtained. It appeared, however, that certain details of the method had to be studied further before practical application of the technique could be recommended. Additional work, therefore, concerned the development of an automatic cane sampler; the determination of Brix-free water per cent fibre, and the development of a quick method of determining fibre in cane samples.

### The Quality of Natal Raw Sugars

It is the general experience of many refineries in various countries that Natal raw sugars are more difficult



om te raffineer. Hierdie feit word dikwels toegeskryf aan klimaatstoestande, die tipe grond en ander gelyksoortige invloede. Toe Ubasuiker—die grootste gedeelte van die oes wat in hierdie land gemaak word—nog die mees algemeen gebruikte suiker was, is daar gedink dat die hoë stysel-inhoud van Uba-sap die oorsaak was. Om duidelikheid te verkry oor die uitwerking van spesifieke nie-suikers, wat die raffineerbaarheid van Natal se rusuikers mjskien kan bepaal, is 'n sistematiese ondersoek na die aanwesigheid van sulke nie-suikers en die uitwerking daarvan op die filtreerbaarheid van oplossings van rusuiker ingestel. Groter hoeveelhede stysel as in oorsese rusuikers is ook daarin gevind, en 'n afsonderlike ondersoek het gewens verskaf i.v.m. die filtreerbaarheid van suikeroplossings. Ander nie-suikers soos was en fosfate is ondersoek.

Die volgende probleem, na bepaling van die belangrikheid van stysel, was die verwydering van stysel uit rou sap voordat dit deur hitte en die werking van kalk in die suiweringsproses oplosbaar gemaak is.

Ten einde hierdie probleem op te los is eksperimente by een van die fabriekse uitgevoer waar gepoog is om stysel uit gemengde sap te verwyder d.m.v. 'n sentrifugale afskeier. Die ondersoek sal in 1958 voortgesit word.

#### SUID-AFRIKAANSE WOLTIESTIELNAVORSINGSINSTITUUT

*Direkteur:* DR. C. C. KRITZINGER

Die agste jaar van die Instituut se bestaan is deels aan verdere ontwikkeling en deels aan die konsolidering van die reorganisasie- en ontwikkelingswerk van die vorige jaar gewy. Die gevolge van die beleid wat die Raad van Beheer gevolg het, is reeds te bespeur aan die aantal navorsingsprojekte wat afgehandel is en wat tans voortgesit word.

In die jaar is 'n spesiale gebou teen 'n koste van sowat £14,500 voltooi om die wolwasinstallasie, die verf- en afwerkingstoerusting, 'n werkplaas, ketelkamer plus koleruim en kleedkamers te huisves. Die gebou en installasie is op 19 September 1957 deur dr. J. H. Moolman, voorsitter van die Raad van Beheer en voorsitter van die Suid-Afrikaanse Wolraad geopen. Die administratiewe werk van die afgelope twee jaar is in hoofsaak aan behoorlike voorsiening van navorsingsgeriewe bestee. In dié tyd het die direkte koste van die geriewe gestyg van £17,650 tot £82,570, waarvan £47,550 aan grond en geboue bestee is.

'n Belangrike toevoeging aan die navorsingstoerusting is die wolwasinstallasie, 'n proefinstallasie wat teen 'n koste van byna £12,000 opererig is. Hoewel hierdie installasie goed gebruik kan word, sal hy eers regtig ten

to refine than raw sugars from other countries. The reason for this shortcoming in the refining quality is, more often than not, vaguely attributed to climatic conditions, nature of the soil and influences of a similar nature. When Uba cane was still the most common variety, forming the major portion of the crop crushed in this country, the high starch content of Uba juice was thought to be the cause.

To clarify the position in respect of the effect of specific non-sugars, which may determine the refining quality of Natal raws, a systematic investigation into the presence of such non-sugars, and their effect on, in the first instance, the filterability of raw sugar solutions was commenced. Starch was still found to be present in larger quantities than in overseas raws, and a separate investigation provided data on the effect on the filterability of sugar solutions. Other non-sugars investigated were wax and phosphates.

The importance of starch having been ascertained, the next problem was the removal of starch from raw juice before it is solubilized by heat and the action of lime in the clarification process. In an effort to solve this problem, experiments were carried out at one of the factories, where an attempt was made to remove starch from mixed juice by passing through a centrifugal separator. The investigation will be continued in 1958.

#### SOUTH AFRICAN WOOL TEXTILE RESEARCH INSTITUTE

*Director:* DR. C. C. KRITZINGER

The eighth year of the Institute's existence was devoted partly to further development and partly to consolidation of the reorganization and development of the previous year. The results of the policy followed by the Board of Control have already begun to show, as reflected in the number of research projects completed and being pursued.

A special building was completed during the year at a cost of about £14,500 to house the wool washing set, dyeing and finishing equipment, a workshop, boiler room and coal bunker, and change rooms. The building and plant were opened on 19th September, 1957, by Dr. J. H. Moolman, Chairman of the Board of Control and Chairman of the South African Wool Board.

The major portion of the administrative effort during the past two years concerned proper provision of research facilities. During that period the prime cost of these facilities increased from £17,650 to £82,570, of which £47,550 represents land and buildings.

An important addition to the research equipment is the unique pilot-scale wool washing plant, installed at a cost of nearly £12,000. Whilst very good use can be and is already being made of this plant, it will only fulfil its



volle aan sy doel beantwoord wanneer die navorsingswerk wat hier uitgevoer word, in 'n geskikte kaard- en kammasjien voortgesit kan word. Die geraamde prys van laasgenoemde toerusting is £25,000, 'n bedrag wat die Instituut op die oomblik nie kan bekostig nie.

Die Instituut se jaarverslag, wat apart gepubliseer word, bevat volle besonderhede van die werk wat reeds voltooi is of tans onderneem word.

Pogings word nog steeds aangewend om nadere en doeltreffender samewerking ten opsigte van die programme van die S.A.W.T.N.I. en soortgelyke institute op ander plekke in die wêreld te verkry. Die Direkteur het in November in Londen 'n konferensie van direkteurs van woltekstielfnavorsingswerk uit tien lande, wat deur die Internasionale Wolsekretariaat gesteun is, bygewoon, waar die saak aandag geniet het. Uit die besprekings het geblyk dat die Instituut 'n buitengewone geleentheid het om navorsing te doen op wat as onbetrede gebied tussen landbou- en tekstielnavorsing beskryf kan word.

Werk in verband met die suur-alkalie-absorpsie van angorahaar in vergelyking met wol, is voortgesit in 'n poging om meer kennis van die verskil in gedrag van die twee soorte vesels op te doen. Geen opvallende verskille is egter waargeneem nie.

'n Studie van die gedrag van wol en angorahaar tydens die verproses het aan die lig gebring dat die absorpsie afhang nie alleen van die deursnee van die vesels nie, maar ook, en veral, van die mate van verweringskade. 'n Metode is ontwikkel waarvolgens sowel die vesel-deursnee as die mate van verwerking gemeet kan word.

Dit het geblyk dat die blou kleur wat uitloog wanneer wol in gespesifiseerde toestande, met 'n voorgeskrewe oplossing van ninhidrin gekook word, by onbeskadigde wol en angorahaar 'n funksie van die veseldiameter is. Die mate waarin hierdie lineêre verhouding afwyk, is die mate van verwerking. Die reaksietoestande is ondersoek, maar die vraagstuk van die reaksie self bly in groot mate onopgelos.

Die werk het bewys dat verweringskade tot 'n diepte kan gaan wat nege uit die twaalf maande se groei verteenwoordig. Dit het heelwat lig gewerp op vraagstukke soos dié van verkisting by kaarding en die voorkoms van uitkamsels. Volgens 'n verdere studie blyk dit ook dat die beweerde hoë verviltbaarheid van Suid-Afrikaanse wol miskien verband hou met 'n opvallende mate van verwerking. 'n Begin is gemaak met die studie van sekere aspekte wat lig sal werp op sommige van die landbou-faktore wat in aanmerking geneem behoort te word by pogings om verliese weens verwerking te verminder.

Bovermelde projekte in verband met verwerking was enigsins empiries van aard, aangesien feitlik niks bekend is omtrent die veranderings wat keratien tydens verwerking ondergaan nie. 'n Ondersoek is aangepak om die aanwesigheid van swavelbevattende verbindings in verwerde wol vas te stel en die chemie daarvan te bestudeer op grond van bevindings dat daar veranderings in die sisteen/sisteenrantsoen en ook swavelverlies tydens

purpose completely when the research work done here can be followed up in a suitable carding and combing plant. The estimated cost of this latter plant is £25,000 which, for the present, is beyond the Institute's financial resources.

Full details of the research work completed or being undertaken of which a summary is given below, can be found in the Institute's Annual Report which is published separately.

Efforts were continued to obtain closer and more effective integration of the research programmes of SAWTRI and similar institutes elsewhere in the world. The Director attended a conference of wool textile research directors from ten countries sponsored by the International Wool Secretariat and held in London during November, where this matter received attention. It became clear during the discussions that the Institute had a unique opportunity of doing research work in that field which may be described as the gap between agricultural and textile research.

Work was continued on the acid/alkali absorption of mohair in comparison with wool, in an attempt to obtain more information on the difference in behaviour of the two fibres. No marked differences were, however, observed.

Studies on the dyeing behaviour of wool and mohair revealed that the absorption not only depends upon the fibre diameter but also, and especially upon the extent of weathering damage. A dye absorption technique was devised for measuring fibre diameter as well as the degree of weathering.

It was found that the blue colour, leaching out of wool when it is boiled with a prescribed solution of ninhydrin under specified conditions is a function of the fibre diameter in undamaged wool and mohair. The extent of deviation from this linear relationship is a measure of the extent of weathering. The conditions of the reaction were investigated but the problem of the reaction itself remains largely unsolved.

This work showed that weathering damage can extend to a depth of nine out of twelve months growth, and it shed considerable light on such problems as card waste and noil formation. In a further study it was also shown that the reputedly high feltability of South African wool may be related to a marked degree of weathering. Work was started on certain aspects which should elucidate some of the agricultural factors that have to be taken into consideration in efforts to minimise losses through weathering.

The above projects on weathering were somewhat empirical in character, since virtually nothing is known of the changes brought about in the keratin during weathering. An investigation was started on the occurrence and chemistry of sulphur-containing compounds in weathered

verwering voorkom. Hierdie werk sluit aan by ondersoek in verband met die chemiese aard van die sogenaamde staalwolsoorte as gevolg van 'n gebrek aan sporelemente soos koper en kobalt.

'n Vergelykende waardebeplating in veldtoestande van 'n aantal vloeistowwe vir die merk van skape het getoon dat een van die belangrikste faktore wat die uitwasbaarheid van sulke vloeistowwe bepaal, die soort wol is. Wol van die swartpunte tipe was baie moeilik uit. Daar is ook vasgestel dat die tyd en die konsentrasie van die kleuropigment elk by die wasbaarheid 'n belangrike rol speel.

Studies in verband met die uitspoel van wol en die was van angorahaar is gedurende die jaar voortgesit. Party van die laboratorium se bevindings is getoets en ten volle met behulp van die proefwasinstallasie gestaaf. Onder andere is ook 'n vergelykende studie van die doeltreffendheid van 'n aantal wasmiddels daarmee getoets.

wool, on the basis of findings that there is a change in the cystine/cysteine ration as well as a loss of sulphur during weathering. This work is related to investigations into the chemical nature of the so-called steely wools resulting from a lack of trace elements such as copper and cobalt.

A comparative evaluation under field conditions of a number of sheep marking fluids revealed that one of the important factors controlling the scourability of such fluids is the type of wool. Wool of the tar-tip type scours with great difficulty. It was also established that time and the concentration of the colouring pigment play important roles in scourability.

Studies on the rinsing of wool and the scouring of mohair were continued during the year. Some of the laboratory findings were tested and completely confirmed on the pilot-scale washing set, where amongst other studies a comparative study was made of the efficiency of a number of scouring agents.



# Research Bursaries and Assistantships

awarded by the C.S.I.R. during 1958

## Navorsingsbeurse en Assistenteskappe

wat gedurende 1958 deur die W.N.N.R. toegeken is

### GENERAL RESEARCH—ALGEMENE NAVORSING

#### BURSARIES—BEURSE

##### Senior Bursaries/Senior Beurse (£200—£1,000)

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
BOTTO, Dr. G. D. L. D.Phil. Research Bursar £480	Transvaal Museum	Catalogue of South African coleoptera. (Previous awards 1954—1957.) Katalogus van Suid-Afrikaanse coleoptera. (Vorige toekennings 1954—1957.)
TAGER, Dr. J. M. B.Sc.(Agric.) met lof (U.P.) 1947 Ph.D. (Univ. van Kalifornië) 1952 Senior Beurshouer £1,000	Universiteit van Pretoria	<ol style="list-style-type: none"> <li>1. Die metabolisme van vrugte.</li> <li>2. Die Pentose-siklus.</li> <li>3. Die invloed van kewerbehandeling op die groei van perskekiemplantjies.</li> <li>4. Die invloed van rookmis op die groei en mitokondriale aktiwiteit van hawerkiemplantjies. (Vorige toekennings 1954—1957.)</li> </ol> <ol style="list-style-type: none"> <li>1. The metabolism of fruit.</li> <li>2. The Pentose cycle.</li> <li>3. The influence of beetle control on the growth of peach seedlings.</li> <li>4. The influence of smog on the growth and mitochondrial activity of oat seedlings. (Previous awards 1945—1957.)</li> </ol>
SMITH, Prof. J. L. B. B.A., M.Sc., Ph.D., F.R.S. (S.A.) Research Professor £1,300	Rhodes University	Fishes. (Previous awards 1950—1957.) Visse. (Vorige toekennings 1950—1957.)
JUBB, R. A. B.Sc. (Rhodes) 1930 Hon. Scientific Asst. £500	Rhodes University	Freshwater fishes of Southern Africa. (Previous award 1957.) Varswatervisse van Suidelike Afrika. (Vorige toekening 1957.)
OMER-COOPER, Dr. (Mrs.) J. B.A.(Cantab.) 1925 Ph.D.(Dunedin) 1931 Hon. Lecturer in Zoology £550	Rhodes University	Dytiscidae of Southern Africa. (Previous awards 1955—1957.) Dytiscidae van Suidelike Afrika. (Vorige toekennings 1955—1957.)

<i>Name and Qualifications</i> <i>Naam en Kwalifikasies</i>	<i>Where tenable</i> <i>Waar geldig</i>	<i>Subject of Research</i> <i>Onderwerp van Navorsing</i>
BARNARD, Dr. K. H. B.A. 1908, M.A. 1913 (Cantab.), D.Sc. 1924 (Cape Town) Hon. Curator of Marine Collections S.A. Museum £650	University of Cape Town	Monograph of South African marine mollusca. (Previous awards.) Monografie van Suid-Afrikaanse seeweeddiere. (Vorige toekennings.)
SCOTT, Dr. (Mrs.) K. M. F. B.Sc.(Cape Town) 1933 M.Sc.(Cape Town) 1934 (1st Class Honours) Ph.D.(Cape Town) 1938 Zoology. F.R.E.S. Senior Bursar £800	University of Cape Town	1. Taxonomic study and description of South African caddis flies (trichoptera). 2. Taxonomic and ecological study of the chironomidae of South Africa. (Previous awards 1954—1957.) 1. Taksonomiese studies van Suid-Afrikaanse kokerjuffers (trichoptera). 2. Taksonomiese en ekologiese studie van Suid-Afrikaanse chironomidae. (Vorige toekennings 1954—1957.)
PILLANS, N. S. First Assistant, Bolus Herbarium (1940—1952)	University of Cape Town	A revision of the genus <i>Hermannia</i> in Southern Africa. 'n Hersiening van die genus <i>Hermannia</i> in Suidelike Afrika.
WINTERBOTTOM, Dr. J. M. B.Sc.(London) 1926 Ph.D.(London) 1932 Hon. Ornithologist S.A. Museum, Cape Town £600	University of Cape Town	Geographical and ecological distribution of birds in the Western Cape Province. (Previous award 1957.) Geografiese en ekologiese verspreiding van voëls in die Westelike Kaapprovinsie. (Vorige toekennings 1957.)
WRIGHT, Dr. (Mrs.) W. G. B.Sc.(London) 1912 D.I.C. (Royal College of Science) 1915 Ph.D.(Natal) 1954 Research Bursar £250	University of Natal	Structure of the methine and oxidation products of natalensine. (Previous awards 1953—1957.) Struktuur van die metien en oksidasieprodukte van natalensien. (Vorige toekennings 1953—1957.)

Senior Bursaries (Overseas)/Senior Beurse (Oorsee)

SCHUTTE, Dr. H. J. B.Sc. 1942, U.O.D. 1944 eerste klas M.Sc. 1945 met lof D.Sc.(Leiden) 1952 Senior Beurshouer £300	Zürich	Oor die aritmetika van kwaternêre kwadratiese vorme in samehang met die ideaalteorie van die kwaternione. On the arithmetic of quaternary quadratic forms in conjunction with the ideal theory of the quaterniones.
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<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
STOKER, Prof. P. H. B.Sc.(S.A.) 1946 (Onderskeiding Fisika) M.Sc.(Kaapstad) 1948 (Onderskeiding) D.Sc.(Vrije Universiteit Amsterdam) 1952 Professor in Fisika Senior Beurshouer £400	Universiteit, Pisa, Italië	'n Ondersoek van kosmiese strale met behulp van groot Wilsonkamers of groot "hodoskoopkamers" of met behulp van 'n borrelkamer. An investigation of cosmic rays either by means of large Wilson chambers or "hodoscope chambers" or with the aid of a bubble chamber.
VAN WYK, Prof. C. B. B.Sc. ( <i>cum laude</i> ) 1940 (Stellenbosch) M.Sc. ( <i>cum laude</i> ) 1942 (Stellenbosch) Ph.D.(Cambridge) 1949 Senior Beurshouer £300	Teoretiese groep van CERN Genève	Teoretiese kernfisika. Theoretical nuclear physics.

#### Student Bursaries/Studentebeurse

<b>Physics/Fisika</b>		
VAN DER BERG, J. J. Student £150	Universiteit van Pretoria	Verstrooiingsprobleme, in samewerking met kernfisika-groep. Dispersion problems, in collaboration with nuclear physics team.
VERMAAK, J. S. Student £150	Universiteit van Pretoria	Verstrooiingsprobleme, in samewerking met kernfisika-groep. Dispersion problems, in collaboration with nuclear physics team.
HOLL, C. H. Student £150	Universiteit van Pretoria	Fisika van dun lagies. The physics of thin layers.
WIECHERS, G. Student £250	Universiteit van Pretoria	Meermalige verstrooiing van gamma-strale. (Vorige toekenning 1957.) Repeated dispersion of gamma rays. (Previous award 1957.)
FIEDELDEY, H. Student £250	Universiteit van Pretoria	Ondersoek van geadsorbeerde atome op wolfram met behulp van die veld-elektronmikroskoop. (Vorige toekenning 1957.) Investigation of adsorbed atoms on tungsten by means of the field electron microscope. (Previous award 1957.)
VAN DER WALT, C. M. Student £250	Universiteit van Pretoria	Ondersoek van die verandering van die geleidingsvermoë van dun halfgeleierlagies met temperatuur. (Vorige toekenning 1957.) Investigation of the change in conductivity of thin semiconductor layers with changes of temperature. (Previous award 1957.)

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ISEBECK, K. Student £125	University of the Witwatersrand	Interaction of dislocations and point defects by plastic deformation of alkali halides. (Previous award 1957.) Die interaksie van verskuiwings- en puntdefekte as gevolg van plastiese vormverandering van alkali-haliede. (Vorige toekenning 1957.)
BEIL, H. Student £100	University of the Witwatersrand	Long essay on low lying energy levels of light atomic nuclei. Nuclear excitation with the 2 Me V cascade generator. Laagliggende energiepeile van ligte atoomkerne. Kernopwekking met behulp van die 2-Me V-kaskadeopwekker.
HOUSTON-MCMILLAN, A. S. Student £75	University of the Witwatersrand	The change in resistivity on plastic deformation of pure metals and alloys. Verandering in resistiwiteit by die plastiese vervorming van suiwer metale en legerings.
WRIGHT, A. C. J. Student £150	University of Natal	Energy-range relationship for low voltage. Electrons in light elements. Die verhouding van energie tot spanningsgebied by lae spanning. Elektrone in ligte elemente.
FELDMAN, P. R. Student £150	University of Natal	Construction of an evaporation apparatus for silvering. Die bou van 'n verdampingsapparaat vir versilwering.
MCLACHLAN, D. S. Student £150	University of Natal	Cloud chamber research. Wolkekamernavorsing.
BIESHEUVEL, K. Student £150	University of Natal	Paleomagnetic measurements on rocks of the Cape System in Natal. Paleomagnetiese metings van gesteentes van die Kaapse Sisteem in Natal.
JOHNSON, P. M. Student £250	University of Natal	X-Ray dosage measurements. X-Straaldoseringsmetings.
HACK, M. J. R. Student £250	University of Natal	X-Ray studies using an ionization chamber. X-Straalondersoeke met behulp van 'n ionisasiekamer.
GAY, L. S. Student £250	University of Natal	A comparison of the wave forms of atmospheric originating from discharges over land and over sea. 'n Vergelyking van die golfvorme van lugverstorings wat as gevolg van ontladings bo die aarde en die see ontstaan.
GAERTNER, G. Student £250	University of Cape Town	The determination of Pt and other rare elements in rocks and meteorites. Die bepaling van Pt en ander seldsame elemente in gesteentes en meteoriete.
SHEPSTONE, B. J. Student £300	Universiteit van die O.V.S.	Werwelstroomverliese. Eddy current losses.
MÖHR, J. G. Student £250	Universiteit van Stellenbosch	'n Breë teoretiese navorsing van aspekte van termokernreaksies. A broad theoretical investigation of aspects of thermonuclear reactions.



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VAN AS, D. Student £250	Universiteit van Stellenbosch	Die opname deur plante van Fe 59 in verskillende vorms en by verskillende pH's. The absorption by plants of Fe 59 in different forms and in the presence of different pH-values.
DE KOCK, P. R. Student £250	Universiteit van Stellenbosch	Ondersoek van opgewekte niveaus van atome deur gebruik te maak van Rf-resonansies. An investigation of excited levels of atoms by using Rf-resonances.
WASSERMAN, H. J. Student £250	Universiteit van Stellenbosch	Die massa-analise van monsters N14, N15 met die omegatron en die gebruik van laasgenoemde as massadiskriminator in atoomstraalwerk. The bulk analysis of samples N14, N15 by means of the omegatron and by using the latter as bulk discriminator in atomic radiation.
PIETERSE, P. H. B.Sc.(Stell.) 1947 M.Sc.(Stell.) 1949 Student £250	Universiteit van Stellenbosch	Die bepaling van die f-waardes van Fe-lyne met hoë opwekkingspotensiale met behulp van die snelafstmetode. The determination of the f-values of Fe-lines with high excitation potentials by means of the rapid scanning method.
SNYMAN, G. C. Student £150	Potchefstroomse Universiteit vir C.H.O.	Direkte paarvorming deur $\mu$ -mesone met behulp van 'n Wilsonkamerondersoek. Direct forming of pairs by $\mu$ -mesons by means of a Wilson-chamber investigation.
DE BEER, P. Student £150	Potchefstroomse Universiteit vir C.H.O.	Integraal- en differensiaalspektrum van die harde komponent en van $\mu$ -mesone van kosmiese strale uit verskillende rigtings. Integral and differential spectra of the hard component and of $\mu$ -mesons of cosmic rays from various directions.
KRUGER, J. P. Student £150	Potchefstroomse Universiteit vir C.H.O.	Energiespektrum van alfa-deeltjies van die primêre kosmiese strale of die hoogte-afhanklikheid van sterfvorming deur kosmiese strale. The energy spectrum of alpha-particles of primary cosmic rays or the height dependence of star production by cosmic rays.
VAN DER WALT, A. J. Student £150	Potchefstroomse Universiteit vir C.H.O.	Die verstrooiing van $\mu$ -mesone deur atoomkerne van lood en ander elemente. The dispersion of $\mu$ -mesons by atom nuclei of lead and other elements.
DE VILLIERS, J. A. M. Student £250	Potchefstroomse Universiteit vir C.H.O.	Die verstrooiing van kosmiese straal- $\mu$ -mesone deur verskillende materiale vir verskillende energiegebiede. The dispersion of cosmic ray $\mu$ -mesons by different materials for different energy regions.
HENNING, J. J. Student £300	Max-Planck-Inst. für Physik, Göttingen	Teorie van onstabiele deeltjies. The decaying particles theory.
DRIVER, A. S. Student £250	Rhodes University	Absorption of fluorescence of organic compounds in the vacuum ultra-violet region. Absorpsie van fluoressensie van organiese verbindings in die vakuum-ultravioletgebied.
FINKELSTEIN, N. P. Student £200	Rhodes University	An investigation of the radioactivity of certain naturally occurring isobars. 'n Ondersoek van die radioaktiwiteit van isobare soos hulle in die natuur voorkom.

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LEISEROWITZ, L. Student £250	University of Cape Town	X-ray diffraction work on the structure of a crystal. X-straaldiffraksiewerk in verband met die struktuur van 'n kristal.
THOM, R. G. Student £150	University of Natal	Assemble X-ray tube with interchangeable anticathode. Die monteer van 'n X-straalbuis met verwisselbare anti-katode.
<b>Chemistry/Chemie</b>		
KEATING, W. S. Student £250	University of Natal	An investigation of a small cooling tower. Ondersoek van 'n klein koeltoring.
CROWTHER, P. Student £250	University of Natal	Thermal diffusion in binary liquid mixtures. Warmteverspreiding in binêre vloeistofmengsels.
MOELWYN-HUGHES, J. T. Student £250	University of Natal	A polarographic study of ferric fluoride complexes. 'n Polagrafiese studie van ysterfluoriedkomplekse.
HAWKEWORTH, W. A. Student £250	University of Natal	Thermal diffusion in non-isothermal electrochemical cells. Warmteverspreiding in nie-isotermiese elektrochemiese selle.
SANSBURY, W. J. Student £250	University of Natal	Constitutional studies in the alkaloids of the <i>Amaryllidaceae</i> . Struktuurondersoeke in verband met die alkaloiëde van die <i>Amaryllidaceae</i> .
O'DONOVAN, M. B. Student £250	University of Natal	The saponins of lucerne. Die saponiene van lusern.
REES, L. W. Student £250	University of Natal	Synthesis of hydroxy acids. Sintese van hidroksisure.
ELLIS, C. P. Student £250	University of Natal	High temperature gas viscosities. Viskositeit van gasse by hoë temperature.
DU PLESSIS, M. P. Student £250	University of Natal	Removal of hydrogen sulphide from stack gases with the aid of calcium cyanamide. Die uittrek van waterstofsulfied uit skoorsteengasse met behulp van kalsiumsianamied.
VAN MAARSEVEEN, G. Student £150	University of Natal	One of the following: Reduction of manganese in cyanide solutions, The polarographic determination of acetaldehyde, Volumes of mixing and viscosities of liquid mixtures. Een van die volgende: Reduksie van mangaan in sianiedoplossings, Die polarografiese bepaling van asetaldehyd, Mengvolumes en viskositeite van vloeistofmengsels.
NOURSE, H. H. E. Student £150	University of Natal	One of the following: Theory of viscous flow in liquids, Structural studies of one of the alkaloids of the <i>Amaryllidaceae</i> . Een van die volgende: Die teorie van viskose stroming by vloeistowwe, Strukturele ondersoeke in verband met een van die alkaloiëde van die <i>Amaryllidaceae</i> ."



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EGGERS, S. H. Student £150	University of Natal	One of the following: Reduction of manganese in cyanide solutions, The polarographic determination of acetaldehyde, Volumes of mixing and viscosities of liquid mixtures, Theory of viscous flow in liquids, Structural studies of one of the alkaloids of the Amaryllidaceae. Een van die volgende: Reduksie van mangaan in sianiedoplossings, Die polarografiese bepaling van asetaldheid, Mengvolumes en viskositeite van vloeistofmengsels, Die teorie van viskose stroming by vloeistowwe, Strukturele ondersoeke in verband met een van die alkaloiëde van die Amaryllidaceae.
SIMPSON, C. E. Student £150	University of Natal	One of the following: Reduction of manganese in cyanide solutions, The polarographic determination of acetaldehyde, Volumes of mixing and viscosities of liquid mixtures, Theory of viscous flow in liquids, Structural studies of one of the alkaloids of the Amaryllidaceae. Een van die volgende: Reduksie van mangaan in sianiedoplossings, Die polarografiese bepaling van asetaldheid, Mengvolumes en viskositeite van vloeistofmengsels, Die teorie van viskose stroming by vloeistowwe, Strukturele ondersoeke in verband met een van die alkaloiëde van die <i>Amaryllidaceae</i> .
BARKER, E. F. Student £150	University of Natal	One of the following: Reduction of manganese in cyanide solutions, The polarographic determination of acetaldehyde, Volumes of mixing and viscosities of liquid mixtures, Theory of viscous flow in liquids, Structural studies of one of the alkaloids of the Amaryllidaceae. Een van die volgende: Reduksie van mangaan in sianiedoplossings, Die polarografiese bepaling van asetaldheid, Mengvolumes en viskositeite van vloeistofmengsels, Die teorie van viskose stroming by vloeistowwe, Strukturele ondersoeke in verband met een van die alkaloiëde van die Amaryllidaceae.
WEBBER, R. E. Student £150	University of Natal	Some investigation into particle size distribution in sulphuric acid mists. 'n Paar ondersoeke in verband met die verspreiding van korrelgroottes in swawelsuurdampe.
HELPER, W. E. Student £150	University of Natal	One of the following: Reduction of manganese in cyanide solutions, The polarographic determination of acetaldehyde, Volumes of mixing and viscosities of liquid mixtures, Theory of viscous flow in liquids, Structural studies of one of the alkaloids of the Amaryllidaceae Een van die volgende: Reduksie van mangaan in sianiedoplossings, Die polarografiese bepaling van asetaldheid, Mengvolumes en viskositeite van vloeistofmengsels, Die teorie van viskose stroming by vloeistowwe, Strukturele ondersoeke in verband met een van die alkaloiëde van die Amaryllidaceae.

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GARBUTT, D. C. F. Student £150	University of Natal	One of the following: Reduction of manganese in cyanide solutions, The polarographic determination of acetaldehyde, Volumes of mixing and viscosities of liquid mixtures, Theory of viscous flow in liquids, Structural studies of one of the alkaloids of the Amaryllidaceae. Een van die volgende: Reduksie van mangaan in sianiedoplossings, Die polarografiese bepaling van asetaldheid, Mengvolumes en viskositeite van vloeistofmengsels, Die teorie van viskose stroming by vloeistowwe, Strukturele ondersoeke in verband met een van die alkaloiede van die Amaryllidaceae.
SMITH, M. Y. Student £250	University of the Witwatersrand	A study of the effect of impurities on photosensitivity phenomena. 'n Studie van die uitwerking van onsuierhede op lig-gevoeligheidsverskynsels.
GRANVILLE, A. Student £250	University of the Witwatersrand	Energies of activation for formic acid decomposition by defective solids. Die aktiveringsenergie vir mieresuurontbinding deur defektiewe vaste stowwe.
LOUW, N. J. Student £250	University of the Witwatersrand	Investigation of 3—5 alloys and similar substances as catalysts. 'n Ondersoek van 3—5-legerings en soortgelyke stowwe vir gebruik as katalisators.
JAMES, V. G. Student £250	University of the Witwatersrand	Hydrobiological survey of a vlei on the southern Witwatersrand. 'n Hidrobiologiese opname van 'n vlei op die suidelike Witwatersrand.
RUDORF, I. H. Student £150	University of the Witwatersrand	Factors influencing stability of froths. Faktore wat die stabiliteit van skuim beïnvloed.
GROENEWALD, T. Student £150	University of the Witwatersrand	H <sub>2</sub> overvoltage on tungsten-bronze electrodes. H <sub>2</sub> -oorspanning by wolframbronselktrodes.
TORRANCE, J. D. Student £150	University of the Witwatersrand	Some degradative reactions of cucurbitacin B. 'n Paar degradasie-reaksies van kukurbitasien B.
UNDERWOOD, W. G. E. Student £150	University of the Witwatersrand	The reaction of chloral with certain acid chlorides. Die reaksies van chloraal met sekere suurchloriede.
PEGEL, K. Student £250	University of the Witwatersrand	Study of compounds of type TiCl <sub>4</sub> —Al(Et) <sub>5</sub> , TiCl <sub>3</sub> —Al(Et) <sub>5</sub> . 'n Studie van verbindings van die tipe TiCl <sub>4</sub> —Al(Et) <sub>5</sub> , TiCl <sub>3</sub> —Al(Et) <sub>5</sub> .
ALTENKIRK, B. Student £150	University of the Witwatersrand	The chlorination of aromatic amides. Die chlorering van aromatiese amiede.
RADZIWIŁL, A. Student £150	University of the Witwatersrand	The synthesis of a long-chain fatty sulphonate and determination of its surface evaporation properties. Die sintese van 'n langketting vettige sulfonaat en die bepaling van sy oppervlakverdampingseienskappe.
HAWTREY, A. O. Student £250	University of Cape Town	Role of ribonucleic acids in protein synthesis. Die rol van ribonukleïensure by die sintese van proteïen.



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ROSS-INNES, A. M. H. Student £250	University of Cape Town	To build and to investigate the efficiency of a pulse-extraction column. Die bou en die ondersoek van die doeltreffendheid van 'n pulsekstraksiekolom.
HART, P. M. G. Student £250	University of Cape Town	Absorption isotherms and heats of absorption on zinc oxides with and without valency induction. Absorpsie-isotermie en -warmtegrade by sinkoksiede met en sonder valensie-induksie.
ST. LEGER, R. G. Student £250	University of Cape Town	A comparison of liquid extraction equipment. 'n Vergelyking van vloeistofekstraksieapparate.
MACINTOSH, S. C. Student £150	University of Cape Town	Research project in partial fulfilment of requirements for B.Sc.(Hons.) degree in chemistry. Navorsingsprojek vir die gedeeltelike voldoening aan die vereistes vir 'n B.Sc.(Hons.)-graad in skeikunde.
VAN DER MERWE, M. E. Student £150	University of Cape Town	Research project in partial fulfilment of requirements for B.Sc.(Hons.) degree in chemistry. Navorsingsprojek vir die gedeeltelike voldoening aan die vereistes vir 'n B.Sc.(Hons.)-graad in skeikunde.
WIECHERS, A. Student £150	Universiteit van Pretoria	Solanum en/of ander alkaloïede. Solanum and/or other alkaloids.
CATESBY, C. G. C. Student £150	University of Cape Town	Continued work on n-glycosides of piperazine. Voortgesette werk in verband met n-glikosiede van piperasien.
HELLIG, H. R. Student £150	University of Cape Town	Project to be decided on by the University (Organic). 'n Projek waaroor daar nog deur die universiteit besluit moet word (Organies).
DELPIERRE, G. R. Student £150	University of Cape Town	Research project in partial fulfilment of requirements for B.Sc.(Hons.) degree. Navorsingsprojek vir die gedeeltelike voldoening aan die vereistes vir 'n B.Sc.(Hons.)-graad.
ALDERTON, J. L. Student £150	University of Cape Town	Research as directed by the Head of the Department. Navorsing soos deur die hoof van die departement aangewys.
HOWARD, A. S. Student £250	Rhodes University	An investigation of the constitution of cotyledontoxin. An investigation of the organic constituents of the extractive of <i>Encephalartus altestanii</i> . 'n Ondersoek van die samestelling van kotiledontoksien. 'n Ondersoek van die organiese bestanddele van die geëkstraheerde stof van <i>Encephalartus altestanii</i> .
CRAGG, G. M. L. Student £250	Rhodes University	The isolation and investigation of the phenolic constituents of <i>Leonotis leonurus</i> (Wild Dagga). Die isolering en ondersoek van die fenoliese bestanddele van <i>Leonotis leonurus</i> (Wildedagga).
ROSSEINSKY, D. R. Student £150	Rhodes University	The oxidation by cobalt (III) of other metal ions. Oksidasie deur kobalt (III) van ander metaalione.
DAVIDSON, R. J. Student £125	Rhodes University	Polarographic and colorimetric determination of boron in plant material. Polarografiese en kolorimetriese bepaling van boor in plantmateriaal.

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SMIT, J. A. Student £250	Universiteit van Pretoria	Solanumalkaloïede. Solanum alkaloids.
HUGO, J. M. Student £250	Universiteit van Pretoria	Die aktiewe bestanddele van bitter eivrug ( <i>Solanum melongena</i> ). The active components of bitter egg-plant ( <i>Solanum melongena</i> ).
TROSKIE, C. G. Student £150	Universiteit van Pretoria	Solanien en/of ander alkaloïede. Solanin and/or other alkaloids.
LALAKE, L. D. Student £150	University College of Fort Hare	3-Acetyl-2, 4-dihydroxyquinoline as a complexing agent for cations. 3-Asetiel-2, 4-dihidroksikinolien as 'n verbinding wat komplekse met katione vorm.
<b>Civil Engineering/Siviele Ingenieurswese</b>		
VAN IDDEKINGE, L. Student £250	University of the Witwatersrand	An investigation into the water resources of the Komgha river, C.P. 'n Ondersoek na die waterbronne van die Komgharivier in die Kaapprovinsie.
BARKER, W. R. Student £250	University of the Witwatersrand	The effect of shrinking aggregate on the behaviour of slabs under working loads and at failure. Die uitwerking van krimpende toeslag op die gedrag van betonlae onder werklike belasting en by swigting.
MCKECHNIE, G. Student £250	University of the Witwatersrand	An investigation into the possibility of developing synthetic unit hydrographs for South African rivers. 'n Ondersoek in verband met die moontlikheid om sintetiese eenheidshidrograwe vir Suid-Afrikaanse riviere te ontwikkel.
PEREIRA, B. A. Student £250	University of the Witwatersrand	An investigation into the behaviour of arches subjected to loads beyond the working range. 'n Ondersoek na die gedrag van boë wat aan belastings buite die belastingsgebied onderwerp word.
BOSHOFF, H. G. Student £250	University of the Witwatersrand	An investigation of the behaviour of silt in dams with the aid of models. 'n Ondersoek in verband met die gedrag van slik in damme met die behulp van modelle.
KELLY, M. Student £250	University of the Witwatersrand	Development of an electric analogue computer for the routing of floods in South African rivers. Die ontwikkeling van 'n elektriese parallelberekenaar vir die beheer van oorstromings in Suid-Afrikaanse riviere.
BLIGHT, G. E. Student £300	University of the Witwatersrand	The fundamental mechanics of consolidation in partially saturated soils. Die fundamentele konsolidasiemeganika in gedeeltelik versadigde gronde.



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<b>Electrical Engineering/ Elektrotegniese Ingenieurswese</b>		
WOLMARANS, W. Student £250	University of the Witwatersrand	Investigation of current and voltage waveform of wound rotor and squirrel cage induction motors. 'n Ondersoek in verband met die vorm van die spanningsgolwe van 'n induksiemotor met rotorwikkeling en 'n kortsluitankerinduksiemotor.
COHEN, A. L. Student £250	University of the Witwatersrand	A study of electronic digital computer circuitry. 'n Studie van die bedrading van 'n elektroniese syferrekenmasjien.
MARTINUSSEN, K. H. H. Student £250	University of the Witwatersrand	The effects of dust particles on breakdown voltages in air. Die uitwerking van stofdeeltjies op deurslagspannings in die lug.
KORVINK, G. J. Student £250	University of the Witwatersrand	Armature reaction compensation for speed control, and its effect on the feedback loop. Kompensasie vir die ankerreaksie by snelheidsteheer op die terugvoerlus.
THERON, C. G. Student £250	University of the Witwatersrand	A transducer for accelerometer application. 'n Transduseerder vir gebruik by versnellingsmeters.
BECKER, J. G. A. Student £250	University of the Witwatersrand	Harmonics in induction motors. Botrillings in induksiemotore.
KREFT, K. G. Student £250	University of the Witwatersrand	Horizontal movement of the ionosphere over Johannesburg. Die horisontale beweging van die ionosfeer oor Johannesburg.
POOLE, L. M. G. Student £250	Rhodes University	(a) Design and construction of equipment for continuous recording of the flux density of solar radio noise at a frequency of 300 Mc/s. (b) Observation of the flux density of the basic thermal component and of enhanced radiation in solar radio noise at a frequency of 300 Mc/s. (a) Ontwerp en bou van toerusting vir die deurlopende registrering van die vloeddigtheid van radiofrekwente uitstralingsgeraas vanaf die son op 'n frekwensie van 300 MHz. (b) Waarnemings in verband met die vloeddigtheid van die basiese warmtekomponent en die toename in straling by radiofrekwente uitstralingsgeraas vanaf die son op 'n frekwensie van 300 MHz.
WILD, P. A. T. Student £250	Rhodes University	(a) Design and construction of equipment for continuous recording of the flux density of solar radio noise at a frequency of 300 Mc/s. (b) Observation of the flux density of the basic thermal component and of enhanced radiation in solar radio noise at a frequency of 300 Mc/s. (a) Ontwerp en bou van toerusting vir die deurlopende registrering van die vloeddigtheid van radiofrekwente uitstralingsgeraas vanaf die son op 'n frekwensie van 300 MHz. (b) Waarnemings in verband met die vloeddigtheid van die basiese warmtekomponent en die toename in straling by radiofrekwente uitstralingsgeraas vanaf die son op 'n frekwensie van 300 MHz.

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SHUTER, W. L. H. Student £250	Rhodes University	Observations of the characteristics of solar radio noise outbursts and their correlation with solar and ionospheric phenomena. Waarnemings in verband met die eienskappe van uitbarstings van radiofrekwente uitstralingsgeraas vanaf die son en hul verhouding tot sons- en ionosferiese verskynsels.
HOULDER, A. E. Student £250	University of Natal	An investigation into whistling atmospherics in Durban. 'n Onderzoek na fluitsteurings in die atmosfeer in Durban.
<b>Mechanical Engineering/Meganiese Ingenieurswese</b>		
KOK, A. Student £250	University of the Witwatersrand	Electrolytic plotting tank. Houer vir die elektrolitiese bepaling van veldverdelings.
SKEWS, B. W. Student £250	University of the Witwatersrand	Construction of a "shock tube." Bou van 'n "skokbuis."
RENNIE, L. C. Student £250	University of the Witwatersrand	Investigation of "fluid hammer." Onderzoek i.v.m. 'n "fluid hammer."
<b>Geology/Geologie</b>		
SCHOCH, A. E. Student £250	Universiteit van Stellenbosch	Die kataklasiëte van Noordwesbaai. The cataclasites of Northwest Bay.
RUST, I. C. Student £250	Universiteit van Stellenbosch	Oor die sedimentasie van die Moltenolae naby Molteno, Kaap. On the sedimentation of the Molteno Beds in the vicinity of Molteno, Cape.
HALBICH, I. W. Student £250	Universiteit van Stellenbosch	Morfologiese aspekte van die afsetting van die Dwykaserie naby Loeriesfontein, K.P. Morphological aspects of the deposition of the Dwyka Series in the vicinity of Loeriesfontein, Cape.
DE WAAL, P. Student £250	Universiteit van Pretoria	Die geologie van die gebied tussen Van Reenen en Lady-smith, Natal, met besondere verwysing na die geskiktheid van die gesteentes vir padbouoelindes. The geology of the area between Van Reenen and Lady-smith, Natal, with special reference to the suitability of the rocks for road building purposes.
HENDRIKS, L. P. Student £250	Universiteit van Pretoria	Gesteentes van die sisteme Witwatersrand en Ventersdorp op Zwartkop 82 en omstreke N-W van Muldersdrift, Tvl. Rocks of the Witwatersrand and Ventersdorp systems at Zwartkop 82 and environs N-W of Muldersdrift, Tvl.
HAUSMANN, S. G. Student £250	University of the Witwatersrand	Mineralogical investigation of the mercury ores and the copper lead ores in the Murchison Range, Transvaal. Mineralogiese ondersoeke van die kwiksilwer- en koperloodertse by die Murchisonberge in Transvaal.



<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
MALAN, S. P. Student £250	University of the Witwatersrand	Petrological and mineralogical investigation of the Dominion Reef, Klerksdorp. Petrologiese en mineralogiese ondersoek van die Dominionrif in Klerksdorp.
KEY, C. A. Student £300	University of Cape Town	The Ondurakorume carbonatite, Kalkfeld, S.W.A., and further investigation of other S.A. carbonatites. Die Ondurakorume-karbonatiet in Kalkfeld, S.W.A., en verdere ondersoeke in verband met ander S.A. karbonatiete.
<b>Entomology/Entomologie</b>		
ANDREW, A. Student £150	University of the Witwatersrand	A morphological aspect of the general topic "A morpho- logical and physiological analysis of regulative and non-regulative processes in the development of 'mosaic' eggs of several terrestrial and freshwater invertebrates." 'n Morfologiese aspek van die algemene onderwerp: „'n Morfologiese en fisiologiese ontleding van die regu- lerende en nie-regulerende prosesse by die ontwik- keling van mosafekeiers van verskeie land- en vars- waterinvertebrata."
KRAFT, M. K. Student £250	Rhodes University	Ecology of cattle tick larvae. Die ekologie van beesbosluislarwes.
HULLEY, P. E. Student £150	Rhodes University	Humidity relations of cattle ticks. Vogverhoudings by beesbosluise.
<b>Biology/Biologie</b>		
SCOTT DE BUYS Student £250	Universiteit van die O.V.S.	Mikrobiologiese, fisiologiese ondersoekinge oor die saprofitiese straalswamme. Microbiological and physiological investigations in connection with saprophytic actinomycetes.
<b>Botany/Plantkunde</b>		
PELLETIER, M. M. Student £150	University of the Witwatersrand	Of a cytotaxonomic nature. Van sitotaksonomiese aard.
FRANKISH, M. S. Student £250	University of Natal	Autecological study of some Natal species of <i>Cyperacea</i> . 'n Soortekologiese ondersoek van 'n paar <i>Cyperacea</i> - spesies van Natal.
ATKINSON, J. W. Student £150	University of Natal	Research in the fields of either plant physiology or plant systematics. Navorsing oor of plantfisiologie of -sistematiek.
GOUWS, L. Student £250	Universiteit van die O.V.S.	Studies oor die afbraak van plantaardige afvalprodukte by kompostering. Studies on the decomposition of vegetal waste products in composting.

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navoring</i>
BENADE, A. Student £150	Universiteit van Stellenbosch	Anatomiese ondersoek van die olieklere by 'n paar gekose voorbeelde van die Suid-Afrikaanse <i>Rutaceae</i> en <i>Compositae</i> . Anatomical investigation of the follicle glands with a number of chosen specimens of the South African <i>Rutaceae</i> and <i>Compositae</i> .
<b>Zoology/Dierkunde</b>		
THELEYANE, T. Student £250	University College of Fort Hare	The reproductive system of <i>Zebra achatina</i> with special reference to the seasonal cycles. Die voortplantingsstelsel van <i>Zebra achatina</i> met spesiale verwysing na die seisoensiklus.
DAYAL, E. K. Student £150	University College of Fort Hare	The comparative anatomy of the hearts of <i>Bufo</i> and <i>Rana</i> and a determination of the circulation of the blood through the hearts. Die vergelykende anatomie van die hart van <i>Bufo</i> en <i>Rana</i> en vasstelling van die bloedsomloop deur die hart.
SKINNER, J. Student £300	Universiteit van Stellenbosch	Die sternogenese van <i>Microsaura pumila pumila</i> Daudin. The sternogenesis of <i>Microsaura pumila pumila</i> Daudin.
VISSER, J. G. J. Student £150	Universiteit van Stellenbosch	Veneuse wortels van die phallus van die konyn. Venous roots of the rabbit phallus.
CLOETE, S. E. Student £150	Universiteit van Stellenbosch	Die skedelmorfologie van <i>Rhyacotriton olympicus</i> . The skull morphology of <i>Rhyacotriton olympicus</i> .
BRANDT, F. J. Student £150	University of the Witwatersrand	Development of the nose rudiment in different species of South African frogs. Ontwikkeling van die rudimentêre neus by verskillende soorte Suid-Afrikaanse paddas.
STIGLINGH, I. Student £250	Potchefstroomse Universiteit vir C.H.O.	Bydraes tot die morfologie van <i>Bulinus tropicus</i> ( <i>Basomatophora mollusca</i> ) in Suid-Afrika. Contributions to the morphology of <i>Bulinus tropicus</i> ( <i>Basomatophora mollusca</i> ) in South Africa.
ODHNER, K. C. Student £150	University of Natal	Some topic in micro-anatomy, microtomy and histology and some experimental physiological subject. Een of ander onderwerp met betrekking tot die anatomie, mikrotomie en histologie en 'n onderwerp op die gebied van die eksperimentele fisiologie.
BEYNAN, M. P. Student £150	University of Natal	Some topic in micro-anatomy, microtomy and histology and some experimental physiological subject. Een of ander onderwerp met betrekking tot die mikro-anatomie en histologie en 'n onderwerp op die gebied van die eksperimentele fisiologie.



ASSISTANTSHIPS/ASSISTENTSKAPPE

(a) Grants for the employment of skilled research assistants/Toekennings vir die indiensneming van geskoolde navorsingsassistentente (£450—£650)

Name and Qualifications Naam en Kwalifikasies	Where tenable Waar geldig	Subject of Research Onderwerp van Navorsing
BADENHUIZEN, Prof. N. P. D.Sc.(Amsterdam) Professor of Botany	University of the Witwatersrand	Metabolism of starch production in plants. (Previous awards 1954—1957.) Die metabolisme van styselvoortbrenging in plante. (Vorige toekennings 1954—1957.)
BALINSKY, Prof. B. I. Doctor of Biological Sciences (Kiev.) 1936 F.I.I.E. 1939	University of the Witwatersrand	Analysis of factors controlling the size and differentiation of the organ rudiments in amphibia. (Previous award 1957.) 'n Ontleding van die faktore wat die grootte en differensiering van orgaanrudimente in amphibia bepaal. (Vorige toekenning 1957.)
BARRY, T. H. B.Sc.(Stell.) 1949 M.Sc.(Stell.) 1951 D.Sc.(Stell.) 1955 Lektor Dept. Dierkunde U.P.	Universiteit van Pretoria	Vergelykende esteologiese studies van die genus <i>Dicynodon</i> . Comparative osteological studies of the genus <i>Dicynodon</i> .
BOZZOLI, Prof. G. R. B.Sc.(Eng.)(Rand) 1934 D.Sc.(Eng.)(Rand) 1947 Professor of Engineering	University of the Witwatersrand	Study of long sparks in air and oil. Study of steep fronted voltage surge effects. (Previous awards 1955—1957.) 'n Ondersoek in verband met lang vonke in die lug en olie. 'n Studie van kortstygtyd-spanningsgolfeffekte. (Vorige toekennings 1955—1957.)
DART, Prof. R. A. M.Sc.(Q'I'd) M.D., Ch.M.(Sydney) Hon. D.Sc.(Natal) Professor of Anatomy	University of the Witwatersrand	The recovery of all the fossils to be found in the bone breccia from the limeworks site in the Makapansgat Valley. (Previous award 1957.) Die opgraving van alle fossiele wat in die beenbreccia op die terrein van die kalkgroef in die Makapansgatvallei aangetref word. (Vorige toekenning 1957.)
DAY, Prof. J. H. O. Ph.D.(Liverpool) Professor of Zoology	University of Cape Town	1. The ecology of South African estuaries. (Previous awards 1951—1957.) 2. The ecology of shallow seas.
GOULD, Prof. A. J. Ph.D.(Cantab.), D.Sc. (London), M.I.Mech.E., M.I.C.E., M.I.N.A. Professor of Mechanical Engineering	University of Natal	Chemical inhibition of corrosion-fatigue. Theory of fatigue under asymmetric stressing. (Previous awards 1954—1957.) Die chemiese stremming van korrosievermoeidheid. Die vermoeidheidsteorie onder asimmetriese belasting. (Vorige toekennings 1954—1957.)
HALES, Prof. A. L. B.Sc.(U.C.T.) 1929 M.Sc.(U.C.T.) 1930 Ph.D.(U.C.T.) 1936 Dist. B.A.(Cambridge) 1933, M.A.(Cambridge) 1952. Wrangler in Math. Tripos Director, Bernard Price Institute for Geophysical Research 3 Assistants	University of the Witwatersrand	Crustal structure and paleomagnetic investigations in Southern Africa. Artificial satellite optical tracking programme. (Previous awards 1955—1957.) Korsstruktuur en paleomagnetiese ondersoeke in Suidelike Afrika. 'n Optiese waarnemingsprogram vir die kunssatelliet. (Vorige toekennings 1955—1957.)

Name and Qualifications Naam en Kwalifikasies	Where tenable Waar geldig	Subject of Research Onderwerp van Navorsing
HOLLIMAN, Prof. F. G. B.A.(Cantab.) 1941 M.A.(Cantab.) 1944 Ph.D.(Cantab.) 1944 Professor of Chemistry	University of Cape Town	The pigments of <i>Pseudomonas aeruginosa</i> . (Previous awards 1955—1957.) Die pigmente van <i>Pseudomonas aeruginosa</i> . (Vorige toekennings 1955—1957.)
ISAAC, Prof. W. E. B.Sc. (1928) Harry Bolus Professor of Botany	University of Cape Town	Investigations on the marine algae of Southern Africa. (Previous awards 1952—1957.) Ondersoeke in verband met die see-alge van Suidelike Afrika. (Vorige toekennings 1952—1957.)
ISRAELSTAM, Dr. S. S. M.Sc.(cum laude)(Rand) Ph.D.(Rand) Senior Lecturer in Chemistry	University of the Witwatersrand	1. Reactions of tertiary alkyl hypohalites. 2. The Von Pechmann reactions and the synthesis of coumarins and related compounds. (Previous award 1957.) 1. Reaksie van tersiêre alkielhipohaliete. 2. Die Von Pechmann-reaksies en die sintese van kumarien en verwante verbindings. (Vorige toekenning 1957.)
KING, Dr. J. W. B.Sc.(S.A.) 1949 Hons. B.Sc.(S.A.) 1950 M.Sc.(Rhodes) 1952 Ph.D.(Cambridge) 1955 Hamilton Prize for research on radio propagation Lecturer in Physics	Rhodes University	Intensive ionospheric studies made during the International Geophysical Year. (Previous award 1957.) Intensiewe ionosferiese studies soos tydens die Internasionale Geofisiese Jaar onderneem. (Vorige toekenning 1957.)
KRIJGSMAN, Prof. B. J. Ph.D.(Utrecht) 1928 (1st Class Hons.) Associate Professor of Zoology	University of Cape Town	1. Nerve-sense physiology—aquatic animals. 2. Heart physiology—invertebrate. 3. Osmoregulation. (Previous awards 1953—1957.) 1. Die fisiologie van die senuwees en sintuie van waterdiere. 2. Die hartfisiologie van ongewerweldede diere. 3. Osmoregulering. (Vorige toekennings 1953—1957.)
LOGIE, Prof. H. J. B.Sc.(Rand), B.Sc.(Hons.) (1st Class) D.Sc.(Rand) Professor of experimental Physics	University of the Witwatersrand	Change of resistivity on plastic deformation of alloys. (Previous award 1957.) Verandering in resistiwiteit by die plastiese vervorming van legerings. (Vorige toekenning 1957.)
LUTJEHARMS, Prof. Dr. W. J. Nat. Ph.D.(Leiden) 1936 Professor in Plantkunde en Hoof van die Departement vir Bodembioëgie	Universiteit van die O.V.S.	Mikrobiologiese ondersoeke oor die bodempopulasie en die koolstof- en stikstofkringlope in die grond. (Vorige toekennings 1953—1957.) Microbiological investigations regarding the soil population and the carbon and nitrogen cycles in the soil. (Previous awards 1953—1957.)
PHILLIPS, Prof. W. E. B.Sc.(Eng.) 1929 M.Sc.(Eng.) 1933 A.M.I.E.E. (1936) D.Sc.(Eng.) 1947 S.A. M.I.E.E. (1949) Senior M.I.R.E. (1945) M.(S.A.)I.E.E. (1954) Professor of Electrical Engineering	University of Natal	Propagation of microwave radio energy. Radio backscatter from the ionosphere. (Previous award 1957.) Voortplanting van mikrogolf-radioenergie. Radiorefleksie vanuit die ionosfeer. (Vorige toekenning 1957.)



<i>Name and Qualifications</i> <i>Naam en Kwalifikasies</i>	<i>Where tenable</i> <i>Waar geldig</i>	<i>Subject of Research</i> <i>Onderwerp van Navorsing</i>
SEARS, Prof. D. B. D.Sc.(Wits.) 1948 D.Phil.(Oxford) 1949 Professor of Pure Mathematics U.C.T.	University of Cape Town	Stability oscillation problems and spectral theory of differential equations. Stabiliteitskommelingsprobleme en spektrumteorie van differensiale vergelykings.
STACK-FORSYTH, Dr. E. F. B.Sc.(Natal) 1931 B.Sc.(Hons.)(Natal) 1950 Ph.D.(Natal) 1954 A.M.I.E.E. Lecturer	Rhodes University	An investigation of the dynamic spectra of solar radio outbursts. (Previous award 1957). 'n Ondersoek van die dinamiese spektra van sonradio-geluiduitbarstings. (Vorige toekening 1957).
STEYN, W. J. A. M.Sc.(Univ. of S.A.) 1945 Senior Lecturer in Analytical Chemistry	Rhodes University	Mineral status of plants and soils. (Previous awards 1954—1957.) Die mineraalstatus van plant- en grondsoorte. (Vorige toekennings 1954—1957.)
STOKER, Dr. P. H. M.Sc.(Ondersk.) (Kaapstad) 1948 D.Sc.(Vrije Univ. Amsterdam) 1952 Professor in Fisika	Potchefstroomse Universiteit vir C.H.O.	<ol style="list-style-type: none"> <li>1. Integraal- en differensiaalspektrum van die harde komponent van die kosmiese strale en van <math>\mu</math>-mesone in verskillende rigtings.</li> <li>2. Die energieverlies van <math>\mu</math>-mesone van hoë energie in kristalle.</li> <li>3. Direkte paarvorming deur <math>\mu</math>-mesone met behulp van 'n Wilsonkamer ondersoek.</li> <li>4. Anomale verstrooiing van <math>\mu</math>-mesone ondersoek deur 'n telbuischodoskoop.</li> <li>5. Intensiteitsvariasies van die neutronkomponent van die kosmiese strale te Hermanus as bydrae tot die program van die I.G.J.</li> <li>6. Ondersoeke op kosmiese strale met kernemulsies. (Vorige toekennings 1956—1957.)</li> </ol> <ol style="list-style-type: none"> <li>1. Integral and differential spectrum of the hard component of cosmic rays and of <math>\mu</math>-mesons in different directions.</li> <li>2. The loss of energy of <math>\mu</math>-mesons of high energy in crystals.</li> <li>3. Direct pairing through <math>\mu</math>-mesons by means of a Wilson-chamber investigation.</li> <li>4. Anomalous dispersion of <math>\mu</math>-mesons investigated by means of a counter-hodoscope.</li> <li>5. Intensity variations of the neutron component of cosmic rays at Hermanus as a contribution to the program of the I.G.Y.</li> <li>6. Investigations of cosmic rays with nuclear emulsions. (Previous awards 1956—1957.)</li> </ol>
WARREN, Prof. F. L. B.Sc.(1927) D.I.C.(1928) Ph.D.(London)(1929) D.Sc.(London)(1951) A.R.C.S., F.R.I.C., F.R.S.A. Professor of Chemistry and Chemical Technology 2 Research Assistants	University of Natal	South African plants of toxic and medicinal interest with special reference to alkaloids of hypertensive significance. (Previous awards 1951—1957.) Suid-Afrikaanse plante van toksikologiese en geneeskundige belang met spesiale verwysing na die alkaloiëde wat 'n rol speel by verhoogde bloeddruk. (Vorige toekennings 1951—1957.)
YOURGRAU, Dr. W. D.Phil.(Berlin) 1932 Awarded Lincoln Scholarship (Branch of Rockefeller) in 1930	University of Natal	"The nature of constants" (Book containing five chapters to be published in Britain and presumably simultaneously in the States). (Previous award 1957.) „The nature of constants" ('n Boek waarvan vyf hoofstukke in Brittanje en waarskynlik gelyktydig in die Verenigde State gepubliseer gaan word). (Vorige toekening 1957.)

<i>Name and Qualifications</i> <i>Naam en Kwalifikasies</i>	<i>Where tenable</i> <i>Waar geldig</i>	<i>Subject of Research</i> <i>Onderwerp van Navorsing</i>
ZEEMAN, Prof. P. B. B.Sc.(cum laude) 1940 (Stellenbosch) D.Sc.(Stell.) 1950 Professor in Fisika	Universiteit van Stellenbosch	<ol style="list-style-type: none"> <li>1. Die direklesende bepaling van Si in staal.</li> <li>2. Die daarstelling van 'n maklik uitvoerbare kliniese toets om vas te stel of 'n patologiese nier hipertensie veroorsaak.</li> <li>3. Vasstelling van die graad van inkompetensie van die mitraal- en/of aortaklep van die hart gedurende operasie.</li> <li>4. Bepaling van die spoed van bloedvloeiing in verskillende dele van die groot slagare.</li> </ol> <ol style="list-style-type: none"> <li>1. Determination of Si in steel by the direct reading method.</li> <li>2. Elaboration of a feasible clinical test with a view to determining whether a pathological kidney is the cause of hypertension.</li> <li>3. Determination of the degree of incompetence of the mitral and/or aorta valve of the heart during an operation.</li> <li>4. Determination of the blood-flow speed in various parts of the large arteries.</li> </ol>
<b>(b) Grants for the employment of unskilled research assistants/ navorsingsassistentente (£350—£450)</b>		
ROBINSON, Dr. J. T. B.Sc.(1943) M.Sc.(1944) Asst. Professional Officer Vertebrate Palaeontology and Physical Anthropology	Transvaal Museum	Study of the Australopithecines and related fauna. 'n Studie van die Australopithecines en verwante fauna.
SCHAFER, Dr. W. M.Sc.(Univ. of S.A.) 1936 Ph.D.(Univ. of S.A.) 1940 Associate Professor of Physics	University of Cape Town	<ol style="list-style-type: none"> <li>1. Crystal structure of crotonylidene piperidinium chlorostannate.</li> <li>2. A new structure factor computer. (Previous award 1957.)</li> </ol> <ol style="list-style-type: none"> <li>1. Die kristalstruktuur van krotonielideen-piperidiniumchlorostannaat.</li> <li>2. 'n Nuwe struktuurfaktorberekenaar. (Vorige toekening 1957.)</li> </ol>
SMITH, Prof. J. L. B. B.A., M.Sc., Ph.D., F.R.S.(S.A.) Research Professor	Rhodes University	Fishes (3 assistantships). (Previous awards 1950—1957.) Visse (3 assistentskappe). (Vorige toekennings 1950—1957.)



**MEDICAL, DENTAL AND NUTRITION RESEARCH/  
 MEDIESE, TANDHEELKUNDIGE EN VOEDINGNAVORSING**

**Student Bursaries/Studentebeurse**

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
GEFFEN, L. B. Student £150	University of the Witwatersrand	Aspects of work and fatigue in muscle. Aspekte van werk en vermoeidheid by spiere.
ROSENDORFF, C. Student £150	University of the Witwatersrand	Aspects of the humoral transmission and conduction of the nerve impulse. Aspekte van die humorale transmissie en geleiding van die senuwee-impuls.
ISMAIL, A. R. H. Student £150	University of the Witwatersrand	Properties of heart muscle in relation to electrolytes. Die eienskappe van die hartspier met betrekking tot elektroliete.
BOBROW, M. Student £150	University of the Witwatersrand	Anthropological survey of genetical characters in Bantu and Bushmen. 'n Volkekundige opname van genetiese eienskappe by Bantoe en Boesmans.
DONLY, D. L. Student £150	University of the Witwatersrand	Effect of diet and environment on the intermediary metabolism of the rat. Die uitwerking van dieet en omgewing op die intermediêre metabolisme van die rot.

**Senior Bursaries (Overseas)/Senior Beurse (Oorsee)**

JACKSON, W. P. U.	London University College —Hospital	Learning of new techniques to benefit the C.S.I.R./University of Cape Town Endocrine Research Group. Die aanleer van 'n nuwe tegniek ten bate van die W.N.N.R. se groep vir Endokriene Navorsing aan die Universiteit Kaapstad.
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**ASSISTANTSHIPS/ASSISTENTSKAPPE**

**Grants for the employment of skilled research assistants/Toekennings vir die indiensneming van geskoolde navorsingsassistentente**

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
COETZEE, Dr. J. N. M.B.,Ch.B.(Engeland) 1947 M.D.(Engeland) 1952 Senior Lektor	Universiteit van Pretoria	Die genetika van die genus <i>Proteus</i> . (Vorige toekenning 1957.) The genetics of the genus <i>Proteus</i> . (Previous award 1957.)
DEAN, Dr. G. J. M.B.Ch.,B.(Liverpool) 1942 M.R.C.P.(London) 1947 M.D.(Neurology)(Liverpool) 1951 Consultant Physician		Porphyria research. (Previous awards 1955—1957.) Porfirianavorsing. (Vorige toekennings 1955—1957.)

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
DERKSEN, Prof. C. H. M.B. Ch.B.(Kaap) 1939 M.Ch.(U.P.) 1950 Professor	Universiteit van Pretoria	Slagaaroorplanting: (1) Metodes van verkryging, sterilisasie en bewaring van slagare vir oorplanting. (2) Instandhouding van distale bloedsomloop gedurende oorplanting. Dermplastieke in urologie. Arterial grafting: (1) Methods of obtaining, sterilizing and preservation of arteries for grafting. (2) Maintenance of distal blood circulation during the grafting process. Intestinal plastic surgery in urology.
GELDENHUYS, Dr. F. G. M.B. Ch.B.(Wits.) 1945 M.D.(Pretoria) 1950 ( <i>cum laude</i> ). Lid R.C.O.G. (Londen) 1952 Professor in Ginekologie en Obstetrie	Universiteit van Pretoria	Endokrinologiese effek by die vrou in geval van ovariëktomie ten tye van histerektomie. (Vorige toekenning 1957.) The endocrinological effect on the woman in the case of ovariectomy during hysterectomy. (Previous award 1957.)
MARCHAND, Dr. P. M.B. Ch.B.(Wits.) 1944 F.R.C.S. (Royal College of Surgeons) 1947 Ch.M.(Wits.) 1952 Moynihan Prize 1953 Jacksonian Prize 1956 Thoracic Surgeon	University of the Witwatersrand	Arterial grafting of the thoracic aorta. (Previous awards 1956—1957.) Slagaaroorplanting van die borskasaorta. (Vorige toekennings 1956—1957.)
OETTLE, Dr. A. G. B.Sc.(Rand) 1938 B.Sc.(Hons.)(Rand) 1940 M.B. Ch.B.(Rand) 1942 (1st Class Honours) Cancer Research Fellow	S.A.I.M.R.	Cancers in the multimammate mouse ( <i>Rattus (Mastomys) natalensis</i> ). (Previous awards 1955—1957.) Kankergewasse by die vaalveldmuis of moedermuis ( <i>Rattus (Mastomys) natalensis</i> ). (Vorige toekennings 1955—1957.)
PEPLER, W. J. B.Sc.(Pretoria) 1946 M.B. Ch.B.(Pretoria) 1950 M.D.(Pretoria) 1954 Lektor en Assistent-Patoloog	Universiteit van Pretoria	1. Eksperimentele vasculêre degenerasies. 2. Histochemie van die hipotalamiese kerne onder eksperimentele toestande en ander histochemiese probleme. 1. Experimental vascular degenerations. 2. The histochemistry of hypothalamic nuclei under experimental conditions and other histochemical problems.
PIJPER, Prof. A. M.D.(Leyden) 1913 D.Sc.(hon c)(Pretoria) 1933 D.Sc.(hon c)(Kaapstad) 1953 Emeritus Professor in Patologie	Universiteit van Pretoria	Flagella en beweeglikheid van bakterieë. Flagella and mobility of bacteria.



<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
SCHRIRE, Dr. V. M.Sc.(Hons.) 1938 Ph.D. 1940, M.B. Ch.B. (Cape Town) 1941 M.R.C.P. (London and Edinburgh) 1950 Physician Groote Schuur Hospital and University of Cape Town	University of Cape Town	A. 1. The natural history of pericardial effusion. 2. Haemodynamic studies of pericarditis. 3. The intracardiac pressures during and after surgical procedure for relief of constrictive pericarditis. 4. The role of auscultation in the diagnosis of pericarditis. 5. The electrocardiographic and radiological diagnosis. B. 1. The natural history of beri-beri and myocardial failure of unknown aetiology. 2. Haemodynamic studies. C. Studies in coronary vascular disease in Cape Town. D. The effects of long-term anticoagulants on the natural history of coronary vascular disease. E. Studies in mitral stenosis. (Previous award 1957.) A. 1. Die geskiedenis van hartsakuitstroming. 2. Hemodinamiese studies van perikarditis. 3. Die intrakardiale druk tydens en na 'n operasie om verligting van konstriktiewe perikarditis te bewerkstellig. 4. Die rol van beluistering by die diagnose van perikarditis. 5. Elektrokardiografiese en radiologiese diagnose. B. 1. Die geskiedenis van beri-beri en miokardiale instorting van onbekende etiologie. 2. Hemodinamiese studies. C. Studies in verband met kroonaaraandoenings in Kaapstad. D. Die betekenis van langtermyn-stollingsteenmiddels by die geskiedenis van kroonaaraandoenings. E. Studies oor mitrale stenose. (Vorige toekening 1957.)

## Publications

## Publikasies

## A.—C.S.I.R. PERIODICAL PUBLICATIONS/W.N.N.R. SE GEREELDE PUBLIKASIES

**National Building Research Institute**

*Bulletin* (Series DB)—half-yearly articles in relation to the work of the Institute  
Information sheets (Series DIS)—bi-monthly selections of technical enquiries with replies.

**Nasionale Bounavorsingsinstituut**

*Bulletin* (Reeks DB)—halfjaarlikse artikels i.v.m. die werk van die Instituut.  
Inligtingspamflette (Reeks DIS)—tweemaandelikse seleksie van tegniese navrae met antwoorde.

**National Institute for Personnel Research**

*Journal of the N.I.P.R.*—three times per year.

**Nasionale Instituut vir Personeelnavorsing**

*Joernaal van die N.I.P.N.*—driemaal per jaar.

**National Telecommunications Research Laboratory**

*Monthly basic radio-propagation predictions for Southern Africa.*

*Monthly bulletin of ionospheric characteristics observed at Johannesburg and Cape Town.*

**Nasionale Telekommunikasienavorsingslaboratorium**

*Maandelikse voorspellings van basiese radiovoortplanting in Suidelike Afrika.*

*Maandelikse bulletin van ionosferiese karakteristieke soos waargeneem in Johannesburg en Kaapstad.*

**Information and Special Services Department**

*Research Review*—Quarterly.

*Annual Report*

*C.S.I.R. Information*—monthly list of accessions.

*Science News Selections*—weekly for the Technical and Daily Press.

**Departement Inligting en Spesiale Dienste**

*Navorsingsoorsig*—Kwartaalliks.

*Jaarverslag*

*W.N.N.R.-Inligting*—maandelikse byvoegingslys.

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**FINANSIËLE STATE / FINANCIAL STATEMENTS**

**STAAT No. 1**

**BALANSSTAAT SOOS OP 31 MAART 1958**

1956/57	LASTE	1957/58		1956/57	BATES		1957/58		
		£	s. d.		£	s. d.	£	s. d.	
3,133,982	Kapitaalfonds—sien Staat No. 2 .. .. .	1,534,959	17 2	228,382	Kontant	110,405	13 6	163,821	18 11
	Geboue- en Reservekapitaalfonds .. .. .	2,170,708	17 11		(1) S. A. Reservebank—Lopende Rekening	33,019	11 3		
82,541	Toerustingkapitaalfonds .. .. .				(2) Deur Universiteit gehou vir aankoop van Kapitaaltoerusting .. .. .	1,077	13 0		
	Vooruitbetaalde gelde vir— .. .. .	81,280	2 0	637,624	(3) Kasvoorskotrekennings .. .. .	19,319	1 2		
	Ondersoeke, toese en dienste .. .. .	36,321	11 9	56,794	(4) Deposito's .. .. .			790,759	0 5
	Permitgelde vir standaardmerk .. .. .			13,402	Belegings by Staatskuldkommissarisse .. .. .			57,175	19 10
154,818	Diverse Krediteure .. .. .			82,873	Diverse Debiteure .. .. .			32,492	10 8
10,000	Reserwefonds vir die stabilisering van voorgestelde pensioenskema .. .. .			2,891	Ondersoeke en toese aan die gang .. .. .			96,257	3 9
8,366	Lopende Rekening .. .. .			4	Vooruitbetaal vir navorsingstoekennings			4	10 0
265,192	Bitumineuse-Bindstofnavorsingseenheid			157	Goedere in transito .. .. .				
	Appropriasierekening .. .. .				Toerusting onbevreëdigend gelewer .. .. .				
					Afkeuringe .. .. .				
					Vooruitbetaalde uitgawes .. .. .			16	8 0
					Bates op Toerustingkapitaalrekening (teen kosprys)—sien Staat No. 2 .. .. .			1,898,785	5 11
					Grond en Geboue (teen kosprys) .. .. .			1,183,107	7 7
£3,654,899				1,690,630				£4,222,420	5 4
				940,883					
				£3,654,899					

OPMERKING: £1,183,107 7s. 5d. vir grond en geboue sluit nie die waarde in van die terrein deur die Universiteit van Pretoria aan die Raad geskenk nie en vir oordragdoeleindes teen £20,900 gewaardeer.

Pretoria, 26 September 1958  
 Bostaande Balansstaat is ingevolge die bepalings van artikel 56 van die Skatkis- en Ouditwet, No. 23 van 1956, gelees met artikel 13(1)(c) van die Wet op die Wetenskaplike Navorsingsraad, No. 33 van 1945, geaudit en ek sertifiseer dat dit 'n juiste weergawe van die rekenings van die Wetenskaplike en Nywerheidsnavorsingsraad is.  
 Pretoria, 29 Desember 1958

S. M. NAUDE,  
*President.*  
 A. J. MILLER-SMIT,  
*Sekretaris/Treasurier.*  
 (get.) H. S. v. d. WALLT,  
*Kontroleur en Ouditeur-generaal.*





KAPITAALFONDS

STAAT VIR TRANSAKSIES VIR DIE JAAR GEËINDIG 31 MAART 1958

Besonderhede	Aanvaarde Begroting		Totale op 1 April 1957		1957/58 (Netto uitgawe)		Totale op 31 Maart 1958	
	£	s. d.	£	s. d.	£	s. d.	£	s. d.
(A) GEROU- EN RESERWEKAPITAAL-REKENING—								
Geboue .. .. .	270,000	0 0	940,883	0 5	242,224	7 2	1,183,107	7 7
Onbestede saldo .. .. .			254,183	2 10	97,669	6 9	351,852	9 7
<b>TOTALE .. .. .</b>	<b>270,000</b>	<b>0 0</b>	<b>1,195,066</b>	<b>3 3</b>	<b>339,893</b>	<b>13 11</b>	<b>1,534,959</b>	<b>17 2</b>
(B) TOERUSTINGKAPITAALREKENING—								
Meubels, toebehoere en kantoor-toerusting .. .. .	23,400	0 3	139,850	10 3	32,899	3 5	172,749	13 8
Laboratorium- en werkwinkel-toerusting .. .. .	153,854		1,277,312	11 0	148,654	15 6	1,425,967	6 6
Werk aan die gang (Gedeeltelik voltooië toerusting-SABS)	4,545		2,401	10 11	(-)	2,401	10 11	
Voortuie en fiese .. .. .	8,281		115,979	15 10	1,778	9 9	117,758	5 7
Gesubsidieerde motorvoertuie (teen kosprys min terugbetaalings) .. .. .	3,150		2,416	5 10	2,354	11 9	4,770	17 7
Boeke en tydskrifte .. .. .	13,520		90,302	18 2	11,115	13 6	101,418	11 8
Geboue (verpagn)			11,168	8 1			11,168	8 1
Voortafvervaardigde Bouwerk					127	13 11	127	13 11
<b>Koste van bate</b>	<b>206,750</b>		<b>1,690,629</b>	<b>14 10</b>	<b>208,155</b>	<b>11 1</b>	<b>1,898,785</b>	<b>5 11</b>
<b>Onbestede Saldo .. .. .</b>	<b>206,750</b>		<b>248,285</b>	<b>13 9</b>	<b>23,637</b>	<b>18 3</b>	<b>271,923</b>	<b>12 0</b>
<b>TOTALE .. .. .</b>	<b>206,750</b>		<b>1,938,915</b>	<b>8 7</b>	<b>231,793</b>	<b>9 4</b>	<b>2,170,708</b>	<b>17 11</b>
<b>TOTALE VAN (A) EN (B) .. .. .</b>	<b>476,750</b>		<b>3,133,981</b>	<b>11 10</b>	<b>571,687</b>	<b>3 3</b>	<b>3,705,668</b>	<b>15 1</b>

OPMERKING: £1,183,107 7s. 7d. vir grond en geboue sluit nie die waarde in van die terrein deur die Universiteit van Pretoria aan die Raad geskenk nie, en vir oordragdoelindes teen £20,900 gewaardeer.

TOEWYSING VAN ONBESTEDE SALDO

	£	s. d.
(1) Vaste verpligtinge teen Toerustingkapitaalfonds	190,476	0 0
(2) Gehou deur Universiteit vir die aankoop van kapitaaltoerusting .. .. .	33,019	11 3
(3) Gereserveer vir kapitaalisasie van toerusting deur W.N.N.R.—werkplaas en laboratoriums vervaardig .. .. .	18,742	0 0
(4) Nie toegewys nie .. .. .	29,686	0 9
<b>TOTALE .. .. .</b>	<b>£271,923</b>	<b>12 0</b>

S. M. NAUDE,  
President

A. J. MILLER-SMIT,  
Sekretaris/Tesourier.

Pretoria, 26 September 1958



STATEMENT No. 2

CAPITAL FUND

STATEMENT OF TRANSACTIONS FOR THE YEAR ENDED 31ST MARCH, 1958

Details	Accepted Estimates	Totals as at 1st April, 1957			1957/58 (Net expenditure)			Totals as at 31st March, 1958		
		£	s.	d.	£	s.	d.	£	s.	d.
(A) BUILDING AND RESERVE CAPITAL ACCOUNT—										
Land and Buildings	270,000	940,883	0	5	242,224	7	2	1,183,107	7	7
Balance unexpended		254,183	2	10	97,669	6	9	351,852	9	7
TOTALS	270,000	1,195,066	3	3	339,893	13	11	1,534,959	17	2
(B) EQUIPMENT CAPITAL ACCOUNT—										
Furniture, Fittings and Office Equipment	23,400	139,850	10	3	32,899	3	5	172,749	13	8
Laboratory and Workshop Equipment	153,854	1,277,312	11	0	148,654	15	6	1,425,967	6	6
Work in Progress (Partly finished equipment SABS)		2,401	10	11	(-)	2,401	10	11		
Stores on Hand	4,545	115,979	15	10	1,778	9	9	117,758	5	7
Vehicles and Cycles	8,281	51,197	14	9	13,626	14	2	64,824	8	11
Subsidised Cars (at cost less repayments)	3,150	2,416	5	10	2,354	11	9	4,770	17	7
Books and Journals	13,520	90,302	18	2	11,115	13	6	101,418	11	8
Buildings (Leasehold)		11,168	8	1				11,168	8	1
Prefabricated structures					127	13	11	127	13	11
Cost of Assets	206,750	1,690,629	14	10	208,155	11	1	1,898,785	5	11
Balance unexpended		248,285	13	9	23,637	18	3	271,923	12	0
TOTALS	206,750	1,938,915	8	7	231,793	9	4	2,170,708	17	11
TOTALS OF (A) AND (B)	476,750	3,133,981	11	10	571,687	3	3	3,705,668	15	1

NOTE: £1,183,107 7s. 7d. for land and buildings does not include value of site donated to Council by the Pretoria University which was valued at £20,900 for transfer purposes.

ALLOCATION OF UNEXPENDED FUNDS

(1) Firm commitments against Equipment Capital Fund	190,476	0	0
(2) Held by Universities for the purchase of capital equipment	33,019	11	3
(3) Reserved for capitalisation of equipment manufactured in C.S.I.R. workshops and laboratories	18,742	0	0
(4) Not earmarked	29,686	0	9
TOTALS	271,923	12	0

Pretoria, 26th September, 1958

S. M. NAUDÉ,  
President.

A. J. MILLER-SMIT  
Secretary/Treasurer.







APPROPRIASIEREKENING VIR DIE JAAR GEËINDIG 31 MAART 1958

1956/57		1957/58		1957/58	
£	s. d.	£	s. d.	£	s. d.
234,931		288,327	0 8	265,192	0 4
Toewysing deur Raad aan—					
(a)	Geboue- en Reserwekapitaal-fonds . . . . .	48,135	0 4		
(b)	Toerustingkapitaal-fonds . . . . .	25,000	0 0		
(c)	Rekening van Lopende Uitgawes . . . . .	215,192	0 4		
				23,135	0 4
234,931		288,327	0 8	265,192	0 4
Saïdo vir toewysing deur Raad ingevolge Artikel 14(4) van Wet No. 33 van 1945 aan Rekening van Lopende Uitgawes—soos hieronder voorgestel:					
	(i) Voorsiening vir Vaste Verpligtings op Maart 1958 . . . . .	105,870	0 0		
	(ii) Voorsiening vir Vaste verpligtings in 1958-59 nie deur inkomste gedek nie . . . . .	143,030	0 0		
	(iii) Onvoorsiene uitgawes . . . . .	8,607	6 11		
				23,135	0 4
234,931		288,327	0 8	23,135	0 4
265,192		257,507	6 11		
Saïdo oorgedra vir toewysing ingevolge Artikel 14(4) van Wet No. 33 van 1945 . . . . .					
	Rente op beleggings vir toewysing aan Geboue- en Reserwekapitaal-fonds . . . . .				
	S.A.B.S. Reserwekening vir Voorrade in Sentrale Magasyn vir toewysing aan Toerustingkapitaal-fonds . . . . .				
	Beraamde waarde van S.A.B.S.-boeke en -tydskrifte vir toewysing aan Toerustingkapitaal-fonds . . . . .				
				23,135	0 4
265,192		257,507	6 11	23,135	0 4
	Bedrag van inkomste bo uitgawes oorgedra van die Rekening van Lopende Uitgawes . . . . .				
				257,507	6 11
£500,123		£545,834	7 7	£545,834	7 7

Pretoria, 26 September 1958

S. M. NAUDÉ,  
*President.*

A. J. MILLER-SMIT,  
*Sekretaris/Tesourier.*



STATEMENT No. 4

APPROPRIATION ACCOUNT FOR THE YEAR ENDED 31st MARCH, 1958

1956/57		1957/58	
£	s. d.	£	s. d.
234,931		288,327	0 8
265,192		288,327	0 8
Allocation by Council to—			
(a) Building and Reserve Capital Fund	48,135	0 4	
(b) Equipment Capital Fund	25,000	0 0	
(c) Running Expenses Account	215,192	0 4	
234,931		288,327	0 8
Balance for allocation by Council in terms of Section 14(4) of Act No. 33 of 1945 to below:—			
(i) Provision for firm commitments at 31st March, 1958	105,870	0 0	
(ii) Provisions for firm commitments in 1958-59 not covered by income	143,030	0 0	
(iii) Contingencies	8,607	6 11	
500,123		545,834	7 7
1956/57		1957/58	
£	s. d.	£	s. d.
211,066		288,327	0 8
16,671		257,507	6 11
37,500		288,327	0 8
20,000		257,507	6 11
285,237		288,327	0 8
214,886		257,507	6 11
500,123		545,834	7 7
Balance brought forward for allocation in terms of Section 14(4) of Act No. 33 of 1945			
Interest on investments for allocation to Building and Reserve Capital Fund			
S.A.B.S. Central Stores Stock Reserve Account for allocation to Equipment Capital Fund			
Estimated value of S.A.B.S. books and journals for allocation to Equipment Capital Fund			
Excess of Revenue over Expenditure transferred from Running Expenses Account			

Pretoria, 26th September, 1958

S. M. NAUDE,  
President.

A. J. MILLER-SMIT,  
Secretary/Treasurer.







